

Precision LCR Meter

LCR-8101

USER MANUAL

GW INSTEK PART NO. 82DS-22040M



ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

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S SAFETY INSTRUCTION

This chapter contains important safety instructions that you must follow when operating LCR-8101 and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for LCR-8101.

Safety Symbols

These safety symbols may appear in this manual or on LCR-8101.



WARNING

Warning: Identifies conditions or practices that could result in injury or loss of life.



CAUTION

Caution: Identifies conditions or practices that could result in damage to LCR-8101 or to other properties.



DANGER High Voltage



Attention Refer to the Manual



Protective Conductor Terminal



Earth (ground) Terminal

Safety Guidelines

General
Guideline



CAUTION

- Do not place any heavy object on LCR-8101.
- Avoid severe impacts or rough handling that leads to damaging LCR-8101.
- Do not discharge static electricity to LCR-8101.
- Do not block or obstruct the cooling fan vent opening.
- Do not perform measurement at circuits directly connected to Mains (Note below).
- Do not disassemble LCR-8101 unless you are qualified as service personnel.

(Measurement categories) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. LCR-8101 falls under category I.

- Measurement category IV is for measurement performed at the source of low-voltage installation.
- Measurement category III is for measurement performed in the building installation.
- Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.
- Measurement category I is for measurements performed on circuits not directly connected to Mains.

Power Supply



WARNING

- AC Input voltage: 115V/230V, 50/60Hz
- The power supply voltage should not fluctuate more than 10%.
- Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.

Fuse



WARNING

- Fuse type: T3A/250V
- Make sure the correct type of fuse is installed before power up.

- To ensure fire protection, replace the fuse only with the specified type and rating.
- Disconnect the power cord before fuse replacement.
- Make sure the cause of fuse blowout is fixed before fuse replacement.

Cleaning LCR-8101

- Disconnect the power cord before cleaning.
- Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid.
- Do not use chemical or cleaner containing harsh material such as benzene, toluene, xylene, and acetone.

Operation Environment

- Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below)
- Relative Humidity: < 80%
- Altitude: < 2000m
- Temperature: 0°C to 40°C

(Pollution Degree) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. LCR-8101 falls under degree 2.

Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity".

- Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
- Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

Storage environment

- Location: Indoor
- Relative Humidity: < 80%
- Temperature: -40°C to 70°C

Power cord for the United Kingdom

When using LCR-8101 in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

 **WARNING: THIS APPLIANCE MUST BE EARTHED**

IMPORTANT: The wires in this lead are coloured in accordance with the following code:


Green/ Yellow: Earth

Blue: Neutral

Brown: Live (Phase)



As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol  or coloured Green or Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm² should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any moulded mains connector that requires removal / replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

GETTING STARTED

This chapter describes LCR-8101 in a nutshell, including its main features, front / rear panel appearance, and power up sequence. Use the Tutorial section for a quick access to the main functionalities, step by step.



Main Features	Main Features	10
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Main Features

Performance	<ul style="list-style-type: none"> • 20Hz ~ 1MHz wide test frequency • 6 digit measurement resolution • 10mV ~ 2V measurement drive level • 0.1% basic measurement accuracy
Operation	<ul style="list-style-type: none"> • Spot frequency measurement • Multi-step measurement, maximum 64 programs with up to 30 steps each • Actual measurement value display • Measurement in absolute value or percentage difference from the nominal value • Pass/Fail test • Precision fixture with four-wire + ground connection • Fixture trimming, open and closed connection • Bar display mode for easy adjustment of variable components • Graph mode for visual representation of measurement data • Retains panel setup after power-Off • Large LCD display, 320x240 resolution • Intuitive user interface, comprehensive measurement functions
Interface	<ul style="list-style-type: none"> • GPIB • RS-232C

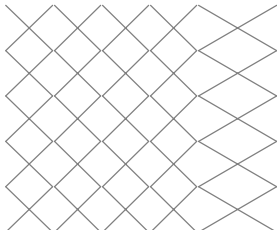
Measurement Type

Measurement item

Primary measurement	Capacitance (C)	Inductance (L)
	Reactance (X)	Susceptance (B) (=1/X)
	Impedance (R)	Admittance (Y) (=1/Z)
	DC Resistance (R_{DC})	
Secondary measurement	AC Resistance (R_{AC})	Quality factor (Q)(=1/D)
	Dissipation factor (D)	Angle (θ) (for Z and Y)

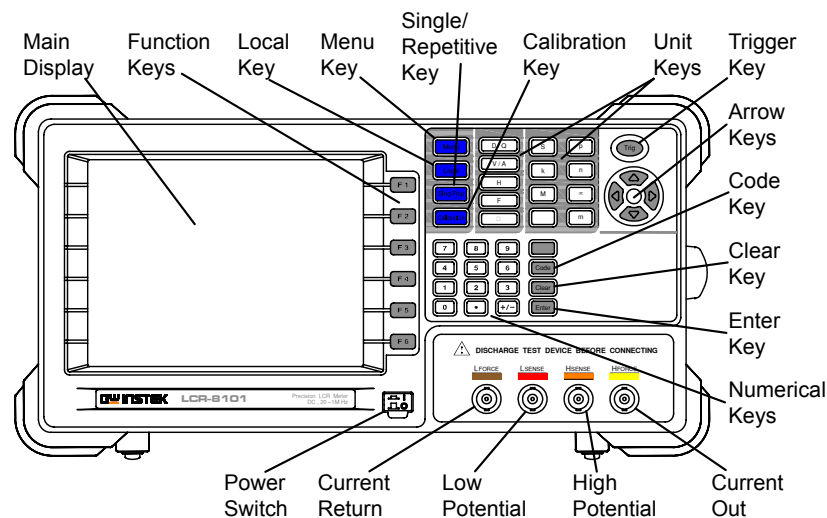
Measurement combination

●:Available, —:Not available

1st measurement	2nd measurement					Circuit model		Graph	Prog
	Q	D	R _{AC}	G	Angle	Series	Parallel		
Capacitance (C)	●	●	●	●	—	●	●	●	●
Inductance (L)	●	●	●	●	—	●	●	●	●
Reactance (X)	●	●	●	—	—	●	—	●	●
Susceptance (B)	●	●	●	●	—	—	●	●	●
Impedance (Z)	—	—	—	—	●	—	—	●	●
Admittance (Y)	—	—	—	—	●	—	—	●	●
DC Resistance(R_{DC})	—	—	—	—	—	—	—	—	●
Quality factor (Q)						●	●	●	●
Dissipation factor (D)						●	●	●	●
AC Resistance (R_{AC})						●	●	●	●
Conductance (G)						—	●	●	●
Angle (θ)						—	—	●	●

*Prog: Multi-step program

Front Panel Overview




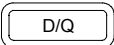
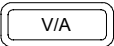
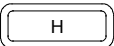
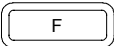
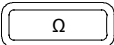











Main display 320 by 240, DST LCD display.


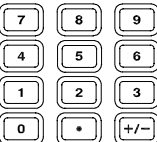

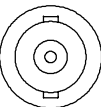

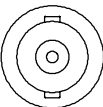

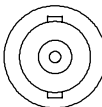

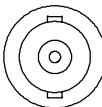



Function keys **F 1** ~ **F 6** Assigned to the menu on the right side of the display.

Local key **Local** When the instrument is under remote control mode, sets the instrument back into local panel operation. For remote control details, see page94.

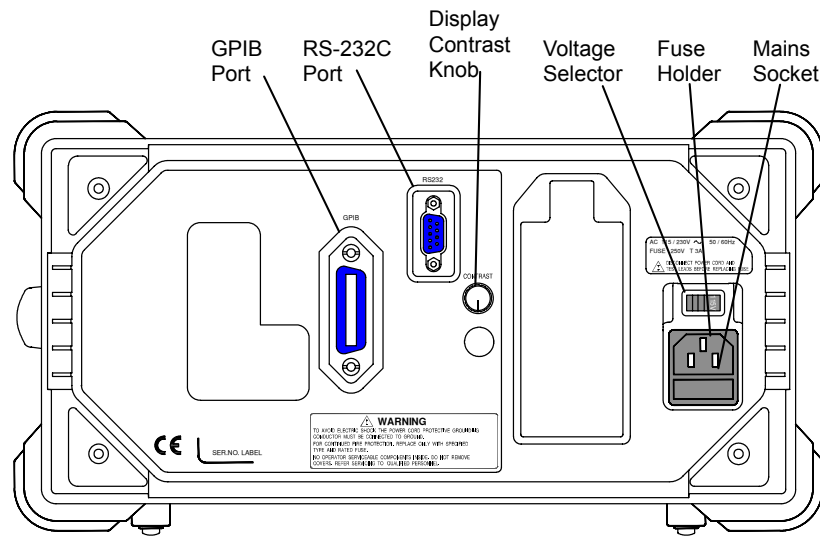
Menu key **Menu** Shows the main menu on the display.

Single/Repetitive key **Sing/Rep** Selects Single measurement mode (manual triggering) or Repetitive measurement mode (automatic triggering). See page49 for details.

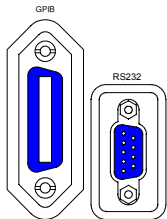
Calibration key		Enters the calibration mode. See page105 for calibration details.
Unit keys	Enters unit when editing values.	
		Dissipation factor or Quality factor
		Voltage or Ampere
		Henry (for Inductance)
		Farad (for Capacitance)
		Ohm (for Resistance, Impedance)
		Siemens (for Susceptance, Admittance)
	 	Kilo (10^3) Mega (10^6)
	 	Pico (10^{-12}) Nano (10^{-9})
	 	Micro (10^{-6}) Milli (10^{-3})
Trigger key		Manually triggers measurement. Available only in Single measurement mode (page49).
Arrow keys		Selects menu items or parameters. The Up/Down and Left/Right keys are used in pairs.
Code key		Enters system codes for changing drive Voltage/Current display (page51) or frequency adjustment resolution (page46).
Clear key		Clears all previous entries when editing values.

Enter key		Confirms the entered value or selection.		
Numerical keys		Enters numeric values.		
Measurement terminals	Accepts measurement fixture. For connection details, see page19.			
	LFORCE	Current return		
	LSENSE	Low potential		
	HSENSE	High potential		
	HFORCE	Current output		
	 	 	 	 
Power switch		Turns On  or Off  the main power. For power up sequence, see page17.		

Rear Panel Overview



GPIB port /
RS-232C port



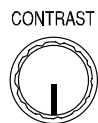
Accepts remote control cables.

GPIB: 24-pin female

RS-232C: DB-9 pin male

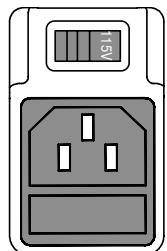
See page94 for remote control details.

Display contrast
knob



Sets the display contrast level. See page17 for details.

Voltage selector /
Fuse holder /
Mains socket



Voltage selector sets the AC mains Voltage, 115V or 230V.

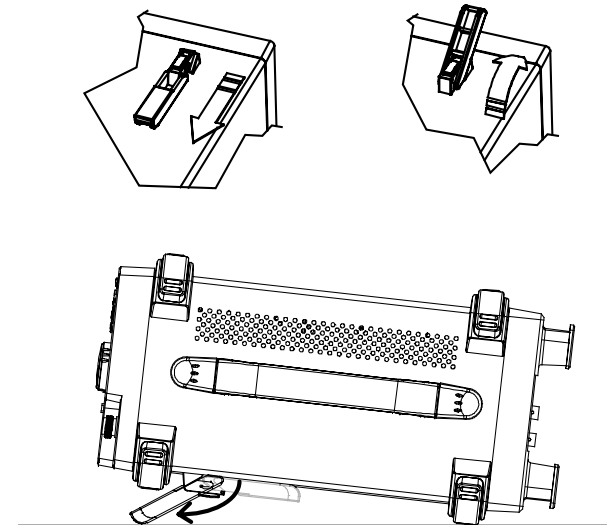
Fuse holder contains the main fuse, T3A/250V. For fuse replacement details, see page110.

Mains socket accepts power cable. See page17 for power-up details.

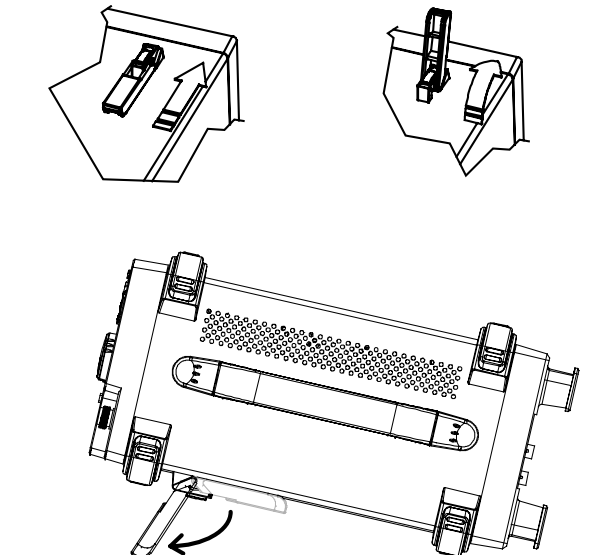
Tilt Stand & Power Up

Tilt stand

Low angle



High angle

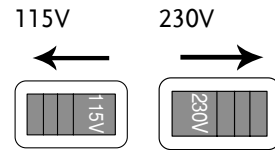


Power up

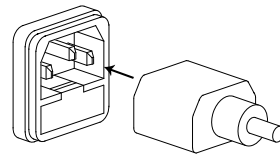
Panel operation



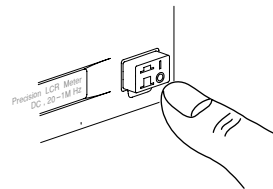
1. Set the rear panel Voltage selector to the correct position according to the AC mains voltage.



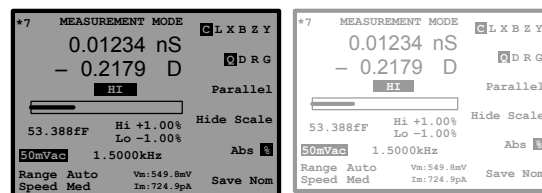
2. Connect the power cord to the socket.



3. Turn On the power switch. The display becomes active in 2~3 seconds.



4. Use the contrast knob on the rear panel to adjust the LCD display brightness.



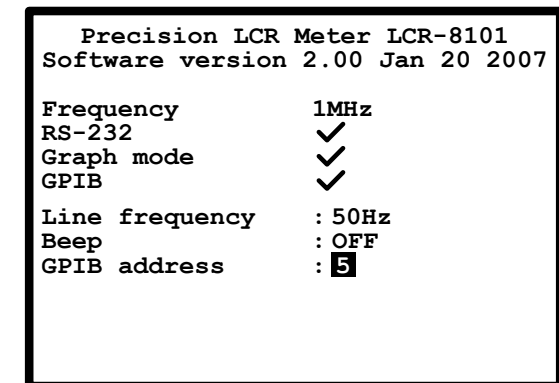
Select AC mains frequency (50/60Hz)

Background

Although LCR-8101 works under both 50 and 60Hz power frequencies, we recommend selecting the frequency that matches the local setting to get the best measurement precision, especially at lower frequencies (< 100Hz).

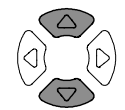
Panel operation

1. Press the Menu key, then F5 (System). The system menu appears.



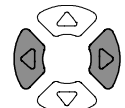
2. Press the Up/Down key and move the cursor to Line frequency.

Line frequency : 50Hz



3. If necessary, press the Left/Right key to select the frequency, from 50 to 60Hz or from 60Hz to 50Hz.

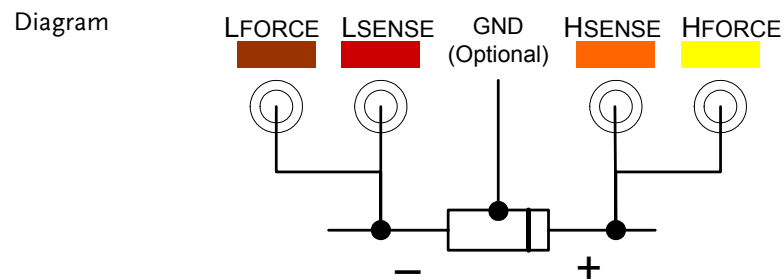
Line frequency : 60Hz



Fixture Connection

Fixture structure

Background The standard fixture is a four-wire type with a common terminal for screen connection. The outer terminals (Hforce and Lforce) provide the current and the inner terminals (Hsense and Lsense) measures the potential.

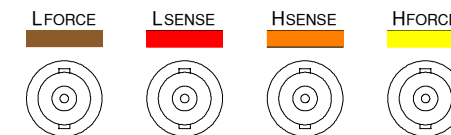


Description	HFORCE	Carries the signal current source. Connected to the + side of the device under test.
	HSENSE	Together with Lsense, monitors the Potential. Connected to the + side of the device under test.
	LSENSE	Together with Hsense, monitors the Potential. Connected to the - side of the device under test.
	LFORCE	Accepts the signal current return. Connected to the - side of the device under test.
	GND	If the test component has a large metal area NOT connected to either of the terminals, connect the GND clip to minimize noise level.

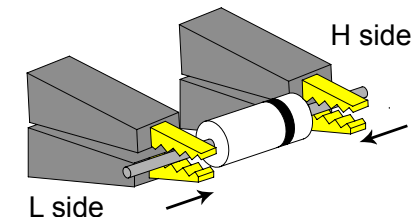
Fixture connection

Panel operation 1. Discharge the test component before connecting the fixture set.

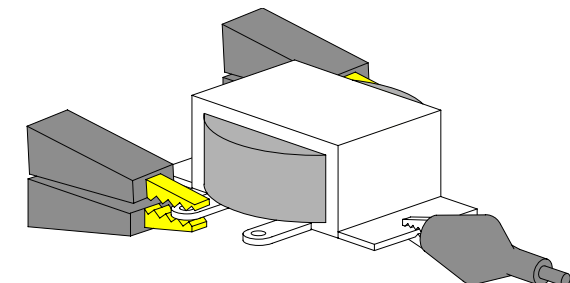
2. Connect each fixture terminal to the front panel BNC connector with matching color.



3. Connect the fixture to the test component. If the component has polarity, connect the H side to the positive lead and the L side to the negative lead. Make sure the distance between the lead base and fixture clip is short enough.



4. If the test component has an outer case unconnected to either of the lead, connect the ground terminal for noise level reduction.



Tutorials (Step by Step Operations)

Basic measurement (without Pass/Fail test)

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Enter menu	Press the Menu key, followed by F1 (AC measurement) or F2 (Rdc).	Page41
3. Hide scale	Press F4 (Show/Hide Scale) to hide the scale (or show the circuit diagram)	Page43
4. Select measurement item	Press F1 (First) and F2 (Second) repeatedly to select the measurement item.	Page44
5. Select series/parallel circuit	If available, press F3 (Series/Parallel) to select the equivalent circuit model.	Page43
6. Set measurement frequency	Press the Left/Right arrow key and move the cursor to the Frequency. Use the numerical and unit keys to set the level.	Page46
7. Set measurement Voltage	Press the Left/Right arrow key and move the cursor to the Voltage. Use the numerical and unit keys to set the level.	Page48
8a. Select Single measurement	Press the Sing/Rep key to select Single (manual trigger) measurement. To trigger measurement, press the Trig key.	Page49
8b. Select Repetitive measurement	Press the Sing/Rep key to select Repetitive (automatic trigger) measurement. Press the Left/Right arrow key and move the cursor to Speed. Press the Up/Down key to select the speed.	Page50
Optional settings	To hide the drive Voltage/Current, press the Code key and type 80, the Enter key. Set the Range (internal setting) to Auto, use the Left/Right key to move the cursor and Up/Down key to change the setting.	Page51 Page45

Pass/Fail test (Single step)

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Set buzzer sound	Press the Menu key, then F5 (System). Press the Up/Down arrow key to move the cursor to Beep, then use the Left/Right key to select setting (Off recommended).	Page54
2. Enter menu	Press the Menu key, followed by F1 (AC measurement) or F2 (Rdc).	Page41
3. Show scale	Press F4 (Show/Hide Scale) to show the scale (or hide the circuit diagram)	Page55
4. Select measurement item	Press F1 (First) and F2 (Second) repeatedly to select the measurement item.	Page44
5. Select series/parallel circuit	If available, press F3 (Series/Parallel) to select the equivalent circuit model.	Page56
6. Set measurement frequency	Press the Left/Right arrow key and move the cursor to the Frequency. Use the numerical and unit keys to set the level.	Page46
7. Set measurement Voltage	Press the Left/Right arrow key and move the cursor to the Voltage. Use the numerical and unit keys to set the level.	Page48
8a. Select Single measurement	Press the Sing/Rep key to select Single (manual trigger) measurement. To trigger measurement, press the Trig key.	Page49
8b. Select Repetitive measurement	Press the Sing/Rep key to select Repetitive (automatic trigger) measurement. Press the Left/Right arrow key and move the cursor to Speed. Press the Up/Down key to select the speed.	Page50

9a. Select Absolute measurement	Press F5 (Abs/%) to select Abs. Press the Left/Right key to move the cursor to Lo (Low limit). Use the numerical and unit keys to set the Low limit. Repeat this for Hi (Hi limit) as well.	Page58
9b. Select Percentage measurement	Press F5 (Abs/%) to select %. Press the Left/Right key to move the cursor to the Nominal value. Use the numerical and unit keys to set the numerical level. Then move the cursor to Lo (Low limit) and set the percentage. Repeat this for Hi (Hi limit) as well. To save the latest measurement result as Nominal, press F6 (Save Nom).	Page59
Optional settings	To hide the drive Voltage/Current, press the Code key and type 80, the Enter key. Set the Range (internal setting) to Auto, use the Left/Right key to move the cursor and Up/Down key to change the setting.	Page51 Page45

Pass/Fail test (Multiple step)

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Set buzzer sound	Press the Menu key, then F5 (System). Press the Up/Down arrow key to move the cursor to Beep, then use the Left/Right key to select setting (Off recommended).	Page62
2. Enter multiple step mode	Press the Menu key, then F3 (Multi step).	Page63
2. Select measurement item	Press the arrow keys to move the cursor to Step 01 Func. Press F1 (Prog) repeatedly to select the item.	Page65
3a. Set parameters	Press the arrow keys to move the cursor to the parameters below. Use the numerical and unit keys for editing values or F1 (Prog) for selecting options.	Page65
3b. Add steps	Move the cursor to the first empty step and press F1 (Prog).	Page65
3c. Copy to the next step	Press F2 (Copy). The selected step contents are copied and inserted to the next step.	Page68
3d. Delete step	Press F3 (Delete). The selected step is deleted.	Page68
4. Save program	Press F4 (Save). The edited program is saved.	Page71
5. Enter Run menu	Press F6 (Run). The Run menu opens.	Page69
6. Set Single or Repetitive	Press the Sing/Rep key to select Single (manual trigger) or Repetitive (auto trigger).	Page69

7. Start running	If the test has not started yet, press F1 (Start) or Trig key. Press F6 (Set) to go back to the setup menu.	Page69
File operation: new program	Press F5 (File), then F4 (New). Press the Left/Right keys to move the cursor and press the Down key to select character. To confirm the file name, press the Enter key. A new file appears. To delete a character, press the Up key. To quit, press the Clear key.	Page63
File operation: load	Press F5 (File), then F1 (Load). Use the arrow keys to select the program and press F1 (Load).	Page73
File operation: delete	Press F5 (File), then F2 (Delete). Use the arrow keys to select the program and press F5 (Del).	Page74
File operation: save as	Press F5 (File), then F3 (Save as). Press the Left/Right keys to move the cursor and press the Down key to select character. To confirm the file name, press the Enter key. A new file appears. To delete a character, press the Up key. To quit, press the Clear key.	Page71

Graph mode

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Enter graph mode	Press the Menu key, then F4 (Graph).	Page76
3. Select item	Press F5 repeatedly to select the graph item.	Page77
4a Set horizontal scale (frequency)	Press the Up/Down key to move the cursor to Sweep. Press the Left/Right key to select Frequency. Then move the cursor to Start Frequency, set the value using the numerical and unit keys. Repeat this for Stop Frequency and Level (drive Voltage).	Page80
4bSet horizontal scale (voltage)	Press the Up/Down key to move the cursor to Sweep. Press the Left/Right key to select Voltage. Then move the cursor to Start Voltage, set the value using the numerical and unit keys. Repeat this for Stop Voltage and Freq (frequency).	Page78
5. Select speed	Press the Up/Down key to move the cursor to Speed. Press the Left/Right key to select the measurement speed.	Page89
6. Select step size	Press the Up/Down key to move the cursor to Step size. Press the Left/Right key to select the data step (all or sampled).	Page89
7. Select linear or log scale	Press F1 (Lin/Log) to select linear or logarithmic horizontal scale.	Page78
8a. Set vertical scale (Absolute + Auto fit)	Press F2 (Abs/ %) to select Abs, then press F3 (Manual/ Auto fit) to select Auto fit. LCR-8101 automatically configures the vertical scale.	Page86

8b. Set vertical scale (Absolute + Manual fit)	Press F2 (Abs/%) to select Abs, then press F3 (Manual/ Auto fit) to select Manual fit. Move the cursor to Hi, set the Hi value. Repeat this for Lo as well. The minimum and maximum vertical range is manually configured.	Page82
8c. Set vertical scale (Percentage + Auto fit)	Press F2 (Abs/%) to select %, then press F3 (Manual/ Auto fit) to select Auto fit. Move the cursor to Nominal and set the nominal value. LCR-8101 automatically configures the vertical range around the nominal value.	Page87
8d. Set vertical scale (Percentage + Manual fit)	Press F2 (Abs/%) to select %, then press F3 (Manual/ Auto fit) to select Auto fit. Move the cursor to Hi, set the Hi percentage. Repeat this for Lo and Nominal. The minimum and maximum vertical range is manually configured.	Page84
9. Plot graph	Press F4 (Start). The graph is drawn on the display. To abort, press F6 (Abort).	Page90
10. Fit graph into display	When plotting is finished, press F1 (Function), then F2 (Fit). The vertical scale is automatically adjusted to include all the plotted line. Press F1 (View) to go back.	Page92
11. Move marker	Press the Left/Right keys to move the marker on the graph. To move the marker to the peak, press F1 (Function) and F3 (Peak). To move to the dip, press F4 (Dip). Press F1 (View) to go back.	Page93
12. Return to previous menu	Press F6 (Return) or press the Menu key to go back to the previous or the other menu.	Page93

Measurement tip

Hi/Low impedance	<p>If the measured impedance is greater than 1kΩ, the standard four-terminal connection is not necessary. Run S/C trim to remove the effect of series lead impedance.</p> <p>If the measured impedance is lower than 1kΩ, four-terminal connection can reduce the effect of contact resistance at the test component.</p>
Metal component case connection	<p>A large area of metal can add noise to the measurement. Here is how to minimize the effect.</p> <p>If the metal is connected to one of the terminals, this should be connected to the Hforce (Yellow) terminal side.</p> <p>If the metal is NOT connected to either of the terminals, connect the GND clip.</p>
Small-sized capacitor	<p>When measuring small, SMD-size capacitors, run O/C trim at the measurement frequency (Spot trimming) to eliminate the residual capacitance. Make sure the measurement lead positions are fixed during trimming.</p>
Small-sized inductor	<p>When measuring small, SMD-size inductors, run S/C trim at the measurement frequency (Spot trimming). LCR-8101 measures the difference between the inductance of S/C trimming and the inductance of test component. Four-terminal fixture set is recommended and make sure the measurement leads are fixed during trimming.</p>
Wire inductance	<p>The wire inductance should be subtracted from the measurement result.</p> <ul style="list-style-type: none"> • 5cm, 1mm diameter wire has 50nH inductance • 5cm, 2mm diameter wire has 40nH inductance

Frequency factor in inductor measurement	When an inductor is measured at a frequency much lower than that for which it is designed (for example, an HF choke tested at AF), the inductor tends to behave as an inductive resistor. In these circumstances, measurement accuracy is widened by $(1 + 1/Q)$ where Q is the quality factor.
Air-cored coils	Air-cored coils can pick up noise very easily, therefore they should be kept well clear of any test equipment that may contain power transformers or display scan circuitry. Also, keep the coils away from metal objects which may modify inductor characteristics.
Iron-cored and ferrite inductor	The effective value of iron-cored and ferrite inductors can vary widely with the magnetization and test signal level. Measure them at the AC level and frequency in use. When core materials are damaged by excessive magnetization (for example: tape heads and microphone transformers), check that the test signal is acceptable before connection.

BASIC MEASUREMENT

Basic measurement measures DUT in numerical style. Advanced measurements are available in Pass/Fail test mode (page52), where measurement results are compared with user-defined limits, and in Graph mode (page75), where measurement data is displayed in graphical representation.

Measurement item	Measurement combination	31
	Series/Parallel circuit models	32
	Resistance (R) and Conductance ($G = 1/R$)	34
	Capacitance (C)	35
	Inductance (L)	36
	Reactance (X) and Susceptance ($B = 1/X$)	37
	Impedance (Z) and Admittance ($Y = 1/Z$)	38
	Quality factor (Q) and Dissipation factor (D) .	39
	Angle (θ)	40
Measurement overview	Enter measurement mode	41
	Display overview	42
	Show circuit model or scale (pass/fail)	43
Measurement configuration	Select measurement item	44
	Set measurement range to Auto	45
	Set measurement frequency	46
	Set measurement voltage	48
Run measurement	Select Single measurement	49
	Select Repetitive measurement	50
	Hide drive Voltage/Current	51

Measurement Item Description

In general, two items, primary and secondary, are combined in a single measurement. The following table shows the available combinations. Overview of each measurement items is listed from the next page.

Measurement combination

●:Yes —:No

1st measurement	2nd measurement					Circuit model		Graph	Prog
	Q	D	RAC	G	Angle	Series	Parallel		
Capacitance (C)	●	●	●	●	—	●	●	●	●
Inductance (L)	●	●	●	●	—	●	●	●	●
Reactance (X)	●	●	●	—	—	●	—	●	●
Susceptance (B)	●	●	●	●	—	—	●	●	●
Impedance (Z)	—	—	—	—	●	—	—	●	●
Admittance (Y)	—	—	—	—	●	—	—	●	●
DC Resistance(RDC)	—	—	—	—	—	—	—	—	●
Quality factor (Q)						●	●	●	●
Dissipation factor (D)						●	●	●	●
AC Resistance (RAC)						●	●	●	●
Conductance (G)						—	●	●	●
Angle (θ)						—	—	●	●

*Prog: Multi-step program

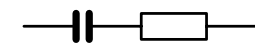
- The graph measurement is described in graph mode chapter, page75.
- The multi-step program mode is described in the Pass/Fail test chapter, page61.

Series/Parallel circuit models

Background For measuring AC Resistance, Capacitance, Reactance, Inductance, and Susceptance, series and parallel equivalent circuit models are available. Select the model according to the component value.

Capacitance (C)

Series diagram

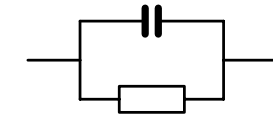


Series formula

$$C_S = C_P (1 + D^2)$$

D=dissipation factor

Parallel diagram



Parallel formula

$$C_P = \frac{C_S}{(1 + D^2)}$$

D=dissipation factor

When to use Series (Cs)

Small capacitance:
Reactance (X) < 1kΩ

Example: 1μF @ 1kHz =
100Ω (X) → Series

When to use Parallel (Cp)

Large capacitance:
Reactance (X) > 1kΩ

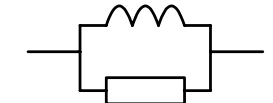
Example: 100mF @ 1kHz
= 100kΩ (X) → Parallel

Inductance (L)

Series diagram



Parallel diagram



Series formula

$$L_S = \frac{L_P}{\left(1 + \frac{1}{Q^2}\right)}$$

Q=quality factor

When to use Series (L_S)

Small capacitance:

Reactance (X) < 1kΩ

Example: 1μH @ 1kHz =
100Ω (X) → Series

Parallel formula

$$L_P = L_S \left(1 + \frac{1}{Q^2}\right)$$

Q=quality factor

When to use Parallel (L_P)

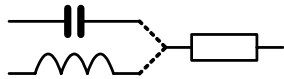
Large capacitance:

Reactance (X) > 1kΩ

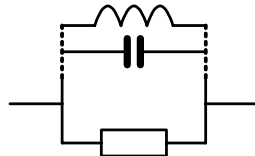
Example: 100mH @ 1kHz =
= 100kΩ (X) → Parallel

Resistance

Series diagram



Parallel diagram



Series formula

$$R_S = \frac{R_P}{\left(1 + Q^2\right)}$$

Q=quality factor

When to use Series (R_S)

Small resistance: < 1kΩ

Parallel formula

$$R_P = R_S \left(1 + Q^2\right)$$

Q=quality factor

When to use Parallel (R_P)

Large resistance: > 1kΩ

Resistance (R) and Conductance (G = 1/R)

Background

Resistance measures how difficult it is for the electricity to flow between two terminals. Conductance is the reciprocal of Resistance and measures how easily the electricity flows.

Resistance

Conductance

Type

- Series Resistance R_S
 - Parallel Resistance R_P
 - DC Resistance R_{dc}
 - Parallel Conductance G_P (= 1/R_P)
- Note: Conductance is available only for parallel circuit model.

Range

0.01mΩ ~ 1GΩ

0.001nS ~ 1GS

Measurement combination

- C_S + R_S
- L_S + R_S
- X_S + R_S
- C_P + R_P
- L_P + R_P
- B_P + R_P
- R_{dc}
- C_P + G_P
- B_P + G_P
- L_P + G_P

Formula

$$R = \frac{I}{V} = \frac{1}{G} = Z_S - jX \quad G_P = \frac{I}{V} = \frac{1}{R} = Y_P - jB$$

$$= Z_S - j\omega L = Z_S + \frac{j}{\omega C} \quad = Y_P - j\omega C = Y_P + \frac{j}{\omega L}$$

$$|Z_S| = \sqrt{(R^2 + X^2)} \quad |Y_S| = \frac{GB}{\sqrt{(G^2 + B^2)}}$$

$$|Z_P| = \frac{RX}{\sqrt{(R^2 + X^2)}} \quad |Y_P| = \sqrt{(G^2 + B^2)}$$

$$R_S = |Z| \cos \theta \quad G_P = |Y| \cos \theta$$

Capacitance (C)

Background	Capacitance measures the amount of electronic charge stored between two terminals.	
Range	0.001pF ~ 1F	
Type	<ul style="list-style-type: none"> Series Capacitance C_S Parallel Capacitance C_P 	
Combination	<ul style="list-style-type: none"> $C_S + Q$ $C_S + D$ $C_S + R_S$ 	<ul style="list-style-type: none"> $C_P + Q$ $C_P + D$ $C_P + R_P$ $C_P + G_P$
Formula	$Z_S = R - \frac{j}{\omega C}$ $Q = \frac{1}{\omega C_S R_S}$ $D = \omega C_S R_S$	$Y_P = G + j\omega C$ $Q = \omega C_P R_P, D = \frac{G_P}{\omega C_P}$

Inductance (L)

Background	Inductance measures the amount of magnetic flux generated in certain electrical current.	
Range	0.1nH ~ 100kH	
Type	<ul style="list-style-type: none"> Series Inductance L_S Parallel Inductance L_P 	
Measurement combination	<ul style="list-style-type: none"> $L_S + Q$ $L_S + D$ $L_S + R_S$ 	<ul style="list-style-type: none"> $L_P + Q$ $L_P + D$ $L_P + R_P$ $L_P + G_P$
Formula	$Z_S = R + j\omega L$ $Q = \frac{\omega L_S}{R_S}, D = \frac{R_S}{\omega L_S}$	$Y_P = G - \frac{j}{\omega L}$ $Q = \frac{R_P}{\omega L_P}, D = \omega L_P G_P$

Reactance (X) and Susceptance (B = 1/X)

Background	Reactance measures the imaginary part of Impedance (Z) caused by capacitors or inductors. Susceptance is the reciprocal of Reactance and measures the imaginary part of Admittance (Y), which is also the reciprocal of Impedance.	
Type	Series Reactance (X _S) Note: Reactance is available only in series circuit model.	Parallel Susceptance (B _P) Note: Susceptance is available only in parallel circuit model.
Range	0.01mΩ ~ 1GΩ	0.001nS ~ 1GS
Measurement combination	<ul style="list-style-type: none"> • X_S + Q • X_S + D • X_S + R_S 	<ul style="list-style-type: none"> • B_P + Q • B_P + D • B_P + R_P • B_P + G_P
Formula	$X = \frac{1}{B} = Z \sin \theta$ $ Z_S = \sqrt{(R^2 + X^2)}$ $ Z_P = \frac{RX}{\sqrt{(R^2 + X^2)}}$ $X_S = Z \sin \theta$	$B = \frac{1}{X} = Y \sin \theta$ $ Y_S = \frac{GB}{\sqrt{(G^2 + B^2)}}$ $ Y_P = \sqrt{(G^2 + B^2)}$ $B_P = Y \sin \theta$

Impedance (Z) and Admittance (Y = 1/Z)

Background	Impedance measures the total amount of opposition between two terminals in an AC circuit. Admittance is the reciprocal of Impedance and measures how easily the electricity flows in an AC circuit.	
Type	Impedance (Z)	Admittance (Y)
Range	0.01mΩ ~ 1GΩ	0.001nS ~ 1GS
Formula	$Z = \frac{E}{I} = \frac{1}{Y}$ $Z_S = R + jX$ $= R + j\omega L = R - \frac{j}{\omega C}$ $ Z_S = \sqrt{(R^2 + X^2)}$ $ Z_P = \frac{RX}{\sqrt{(R^2 + X^2)}}$ $R_S = Z \cos \theta$ $X_S = Z \sin \theta$	$Y = \frac{I}{E} = \frac{1}{Z}$ $Y_P = G + jB$ $= G + j\omega C = G - \frac{j}{\omega L}$ $ Y_S = \frac{GB}{\sqrt{(G^2 + B^2)}}$ $ Y_P = \sqrt{(G^2 + B^2)}$ $G_P = Y \cos \theta$ $B_P = Y \sin \theta$

Quality factor (Q) and Dissipation factor (D)

Background	Both Quality factor and its reciprocal, Dissipation factor, are used for measuring the rate of energy dissipation relative to the measurement frequency. <ul style="list-style-type: none"> Low energy dissipation: high Q, low D High energy dissipation: low Q, high D 	
Type	Quality factor (Q)	Dissipation factor (D)
Range	0.01mΩ ~ 1GΩ	0.001nS ~ 1GS
Formula	$Q = \frac{\omega L_s}{R_s} = \frac{1}{\omega C_s R_s}$ $= \frac{R_p}{\omega L_p} = \omega C_p R_p$ $= \frac{1}{\tan(90 - \theta)^\circ} = \frac{1}{D}$	$D = \frac{R_s}{\omega L_s} = \omega C_s R_s$ $= \frac{G_p}{\omega C_p} = \omega L_p G_p$ $= \tan(90 - \theta)^\circ = \frac{1}{Q}$

Angle (θ)

Background	The Angle (θ) measures the phase on which Impedance (Z), Admittance (Y), Quality factor (Q), and Dissipation factor (D) are measured.	
Type	Angle (θ)	
Range	-180° ~ +180°	
Formula	$Z_s = R + jX$ $= R + j\omega L = R - \frac{j}{\omega C}$ $Q = \frac{1}{\tan(90 - \theta)^\circ} = \frac{1}{D}$ $R_s = Z \cos \theta$ $X_s = Z \sin \theta$	$Y_p = G + jB$ $= G + j\omega C = G - \frac{j}{\omega L}$ $D = \tan(90 - \theta)^\circ = \frac{1}{Q}$ $G_p = Y \cos \theta$ $B_p = Y \sin \theta$

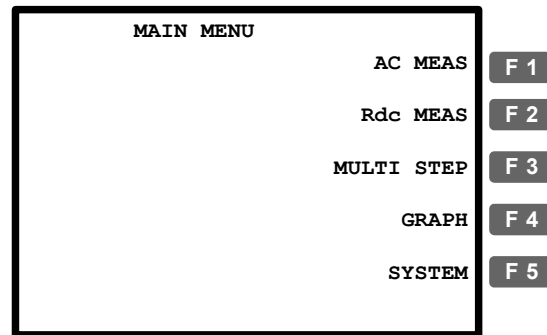
Measurement Mode Overview

Enter measurement mode

Type	AC	C, L, X, B, Z, Y, Q, D, R, G, θ
	DC	Rdc

- Panel operation 1. Press the Menu key. The main menu appears.

Menu

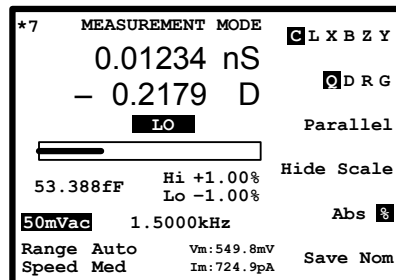


2. For Rdc measurement, press F2 (Rdc Meas).
For any other measurement, press F1 (AC Meas). The measurement mode display appears.

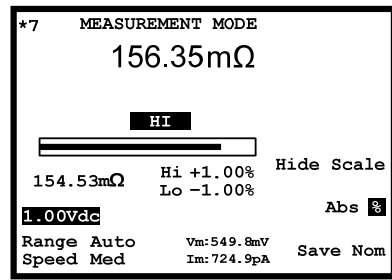
F 1

F 2

AC measurement

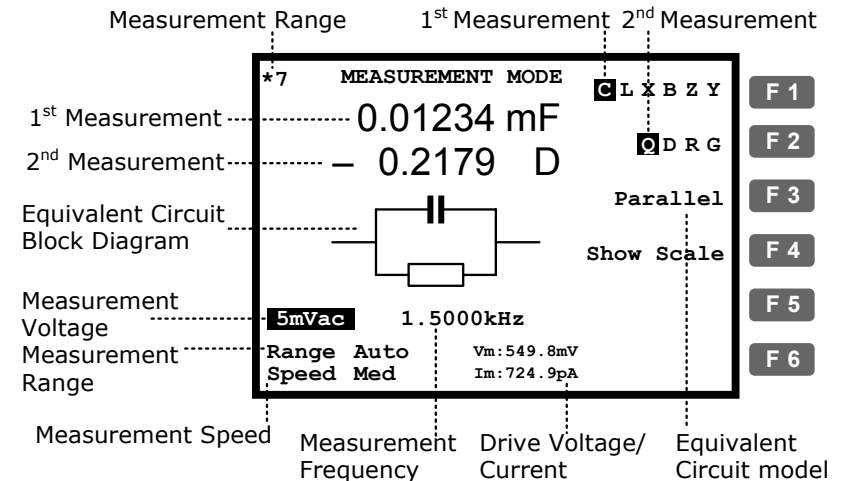


DC measurement (Rdc)



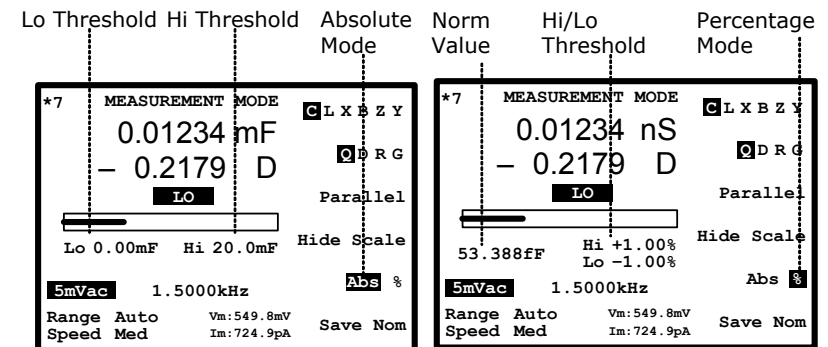
Display overview

Normal mode



Absolute mode (Pass/Fail test)

Percentage mode (Pass/Fail test)



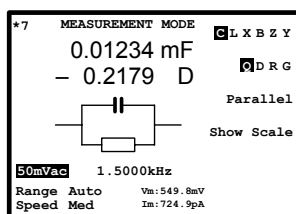
For Pass/Fail test details, see page 52.

Show circuit model or scale (pass/fail)

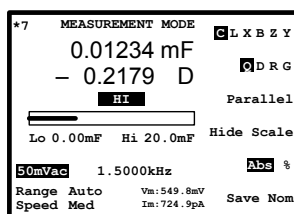
Background The center of the display can be filled with the diagram of equivalent circuit model, or the measurement scale with Pass/Fail test result. This selects not only the diagram/scale but also whether running the Pass/Fail test or just measuring the value.

Panel operation Press F3 (Show/Hide scale) to select circuit model or scale. **F 3**

Normal



Pass/Fail test



Pass/Fail test For Pass/Fail test details, see page52.

Parameter Configuration

Select measurement item

*This is not necessary for Rdc measurement.

Measurement combination	The following list shows the available combination of the first and second measurement items.	
Capacitance (C)	Series	C-Q, C-D, C-R
	Parallel	C-Q, C-D, C-R, C-G
Inductance (L)	Series	L-Q, L-D, L-R
	Parallel	L-Q, L-D, L-R, L-G
Reactance (X)	Series	X-Q, X-D, X-R
Susceptance (B)	Parallel	B-Q, B-D, B-R, B-G
Impedance (Z)		Z-Angle
Admittance (Y)		Y-Angle

Panel operation To select the first measurement item, press F1 repeatedly. **F 1**

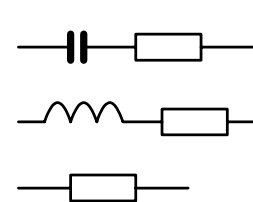
C L X B Z Y

To select the second measurement item, press F2 repeatedly. **F 2**

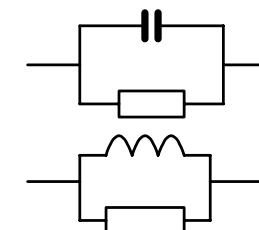
Q D R G

To select the circuit model, series or parallel, press F3 repeatedly. **F 3**

Series

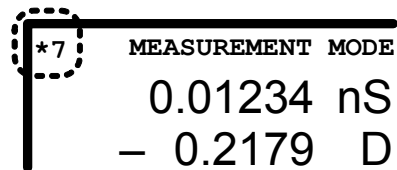


Parallel

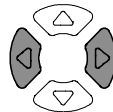


Set measurement range to Auto

Background The measurement range is an internal parameter defining the search range for each measurement item. Make sure the Auto setting is always selected, to obtain the best measurement accuracy. The active range appears at the top left corner of the display.

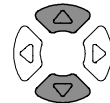


- Panel operation**
1. Press the Left/Right key repeatedly to move the cursor to Range position.



Range Auto
Speed Slow

2. If the range is NOT set to Auto, press the Up/Down key repeatedly to set it back to Auto.



Range 5 → **Range Auto**
Speed Slow → **Speed Slow**

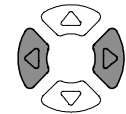
Set measurement frequency

*This setting does not apply to Rdc measurement.

Background The measurement frequency, together with the measurement voltage, defines the electrical condition of each measurement item. Make sure the appropriate frequency is selected, according to the component characteristics.

- Panel operation**
1. Press the Left/Right key repeatedly to move the cursor to Frequency.

2.00 Vac **195.00 kHz**



2. Enter the frequency using the numerical keys.

Range 20Hz ~ 1MHz

1.2kHz **1** **.** **2** **k** **Enter**

1MHz **1** **M** **Enter**

Backspace All clear **Clear**

Increase Decrease

When the entered value does not fit in the range, LCR-8101 automatically selects the nearest value.

Nearest Available

When the wrong unit (such as Ω) is entered, the value is cancelled.

Unit Mismatched

Select frequency step resolution For frequency increase/decrease using Up/Down keys, fine and coarse step settings are available.

Fine 1st digit: 1, 2, 3, 4, 5, 6...

Coarse 2nd digit: 10, 12, 15, 20, 25, 30, 40, 50, 60, 80

1. Press the Code key.



2. Enter the system code using the numerical keys, then press the Enter key. A confirmation message appears on the display.

Fine: 10

Freq fine steps

Coarse: 11

Freq coarse steps

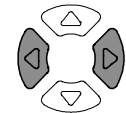
Set measurement voltage

Background

The measurement voltage, together with the measurement frequency, defines the electrical condition of each measurement item. Make sure the appropriate voltage is selected, according to the component characteristics.

- Frequency setting 1. Press the Left/Right key repeatedly to move the cursor to Voltage.

2.00 Vac **195.00 kHz**



2. Enter the voltage using the numerical keys.

Range 10mV ~ 2V

100mV

1V

Backspace All clear

Increase Decrease

When the entered value does not fit in the range, LCR-8101 automatically selects the nearest value.

Nearest Available

When the wrong unit (such as Ω) is entered, the value is cancelled.

Unit Mismatched

Running Measurement

Select Single measurement

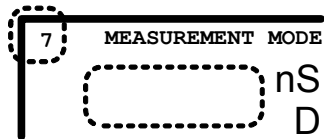
Background The data capture can be manually controlled (Single) or automatically updated (Repetitive).
In single measurement, the measurement is activated by pressing the Trigger key.
In repetitive measurement, the measurement is automatically done and the display is updated according to the speed (timing) setting.

Panel operation 1. Press the Sing/Rep key repeatedly until the "Single Shot Mode" message appears on the display.

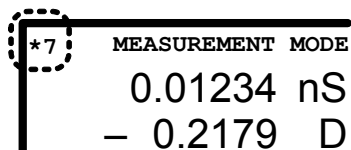


Single Shot Mode

2. The measurement update indicator (*) does not appear at the top left corner of the display.



3. To capture measurement data, press the Trigger key. The measurement update indicator (*) blinks and the measurement result is updated on the display.



Select Repetitive measurement

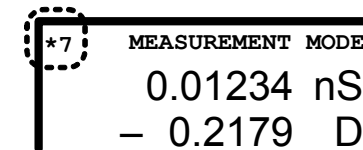
Background The data capture can be manually controlled (Single) or automatically updated (Repetitive).
In single measurement, the measurement is activated by pressing the Trigger key.
In repetitive measurement, the measurement is automatically done and the display is updated according to the speed (timing) setting.

Panel operation 1. Press the Sing/Rep key repeatedly until the "Repetitive Mode" message appears on the display.

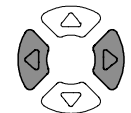


Repetitive Mode

2. The measurement update indicator (*) keeps blinking and the measurement result is updated on the display.

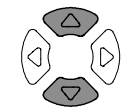


3. Press the Left/Right key repeatedly to move the cursor to measurement speed.



Speed Slow

4. Press the Up/Down key repeatedly to select the time per update.



Slow	500mS
Med	450mS (AC), 120mS (Rdc)

Fast	150mS (AC), 50mS (Rdc)
Max	75mS (AC), 30mS (Rdc)

Beep setting If the beep setting (page54) is active and the display is in Pass/Fail test mode, it might sound continuously depending on the measurement result. If this happens, press the Sing/Rep key and set the mode to Single. Then turn Off the buzzer.



Hide drive Voltage/Current

Background The drive voltage and current shows the actual voltage/current level applied to the device under test.

Vm: 549.8mV
Im: 724.9pA

Panel operation 1. Press the Code key.



2. Enter the system code using the numerical keys, then press the Enter key.

Hide drive V/I: 80



Vm: 549.8mV
Im: 724.9pA



Show drive V/I: 81



Vm: 549.8mV
Im: 724.9pA



PASS-FAIL MODE

In the Pass/Fail test mode, measurement results are compared with user-defined limits and the results are displayed. Two types of tests are available: Single and Multi-Step. The Single test shares the same interface with the basic measurement, and tracks one item. The Multi-Step test runs a program comprised of multiple measurement items with different parameters.

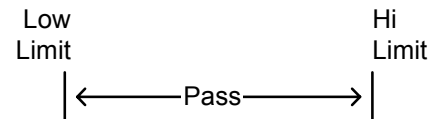
Single-step configuration	Overview	53
	Configure beep setting.....	54
	Select test item and scale (Pass/Fail test).....	55
	Set parameters	56
Single-step run	Run in Absolute mode	58
	Run in Percentage mode	59
	Use display value as nominal.....	60
Multi-step configuration	Overview	61
	Configure beep setting.....	62
	Enter multi-step mode	63
	Create new program.....	63
	Edit program step.....	65
	Copy (duplicate) program step	68
	Delete program step	68
Multi-step run	Run program	69
Multi-step file operation	Save program	71
	Recall (load) existing program	73
	Delete existing program.....	74

Single-Step Test Configuration

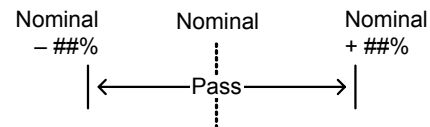
Overview

Background / test type Pass/Fail test checks whether the measurement result sits between hi and low limit. Two methods are available: absolute limit and percentage limit.

Absolute limit The Hi and Low limit are defined by absolute values.



Percentage limit The Hi and Low limit are defined by the distance (percentage) from the Nominal value.



Test item	Cs	Series capacitance	X	Reactance
	Cp	Parallel capacitance	B	Susceptance
	Ls	Series inductance	Z	Impedance
	Lp	Parallel inductance	Y	Admittance
	Rs	Series resistance	R _{DC}	DC Resistance
	Rp	Parallel resistance	θ	Angle

For detailed description of each item, see page 31.

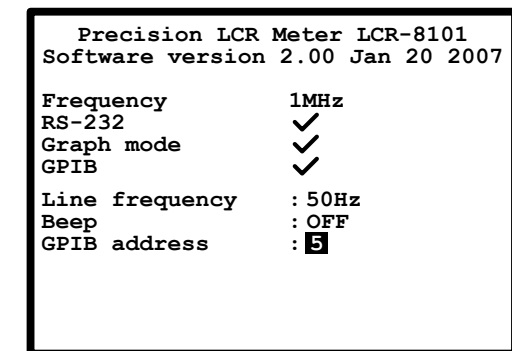
Configure beep setting

Background The beep sounds when the pass/fail test result matches the setting: failed or passed.

Panel operation 1. Press the Menu key, then F5 (System). The system configuration appears.

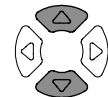


F 5

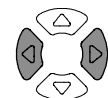


2. Press the Up/Down key and move the cursor to Beep.

Beep : **OFF**



3. Press the Left/Right key to select the beep setting, Off, Pass, or Fail.



Off Beep is turned Off

Pass Beeps when the test result is pass

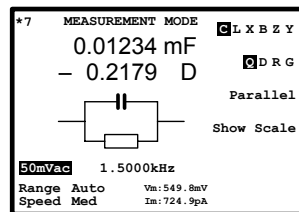
Fail Beeps when the test result is fail

Beep in repetitive mode If the repetitive measurement is On, the beep might sound continuously. If this becomes a problem, either use the Single mode (press Sing/Rep key) or turn Off the beep.

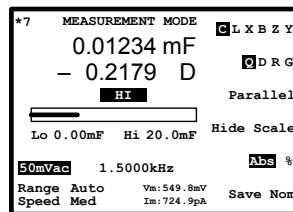
Select test item and scale (Pass/Fail test)

Test item	To select the first measurement item, press F1 repeatedly. C L X B Z Y	F 1
	To select the second measurement item, press F2 repeatedly. Q D R G	F 2
Circuit model	To select the circuit model, series or parallel, press F3 repeatedly.	F 3
Scale	Press F4 (Show/Hide scale) to select scale (Pass/Fail test).	F 4

Normal



Pass/Fail test



Normal mode For Normal (basic) mode details, see page30.

Set parameters

For more detailed descriptions, see Basic measurement, page41.

How to edit

Example 100mV

Backspace

All clear

Increase

Decrease

When the entered value does not fit in the range, the nearest available value is selected.

Nearest Available

When the wrong unit (such as Ω) is entered, the value is cancelled.

Unit Mismatched

Measurement range (to Auto)

Press the Left/Right key repeatedly to move the cursor to Range position, and use the Up/Down key to select Auto (if necessary).

Range Auto
Speed Slow

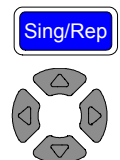
Single mode

Press the Sing/Rep key repeatedly to select Single (manual trigger). To trigger measurement, press the Trigger key.

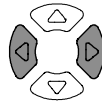


Repetitive mode

Press the Sing/Rep key repeatedly to select Rep (automatic trigger). Press the Left/Right key repeatedly to move the cursor to Speed, and use the Up/Down key to select the update rate.



Frequency (except Rdc) Press the Left/Right key repeatedly to move the cursor to Frequency, and use the numerical and unit keys to enter the value.



2.00 Vac 195.00 kHz

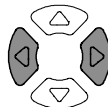
Frequency step resolution For frequency increase/decrease using Up/Down keys, fine and coarse step settings are available.

Press the Code key and enter 10 (Fine) or 11 (Coarse).



Voltage

Press the Left/Right key repeatedly to move the cursor to Voltage, and use the numerical and unit keys to enter the value.



2.00 Vac 195.00 kHz

Single-Step Test Run

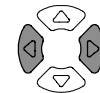
Run in Absolute mode

1. Press F5 to select Absolute measurement.

F 5

Abs %

2. Use the Left/Right key to move the cursor to Hi/Lo value for editing.



Lo 0.00mF Hi 20.0mF

3. Use the numerical keys and unit keys to enter the value. The editing value appears at the bottom left corner of the display.

Range Auto
Speed Med
Lo Lim: 1.5

Example
1.2mΩ



Backspace



All clear



Increase



Decrease



Hi and Lo values are automatically swapped if necessary

Hi and Lo Swapped

4. The display updates the Hi/Lo result immediately. The result is pass if the bar stays in the central area. The buzzer sounds accordingly.

Result > Hi

HI



Result < Lo

LO

Lo < Result < Hi
(Pass)

PASS



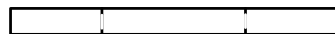
Run in Percentage mode

1. Press F5 to select Percentage measurement.

F 5

Abs %

2. Use the Left/Right key to move the cursor to Hi/Lo value for editing.

100.00mD
Hi +1.00%
Lo -1.00%

3. Use the numerical keys and unit keys to enter the value. The editing value appears at the bottom left corner of the display.

Range Auto
Speed Med
Lo Lim: 1.5

-2.50%

+/- 2 . 5 Enter

1.5kH

1 . 5 k H Enter

Backspace



All clear

Clear

Increase



Decrease



Hi and Lo values are automatically swapped if necessary

Hi and Lo Swapped

4. The display updates the Hi/Lo result immediately. The result is pass if the bar stays in the central area. The buzzer sounds accordingly.

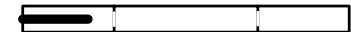
Result > Hi

HI



Result < Lo

LO

Lo < Result < Hi
(Pass)

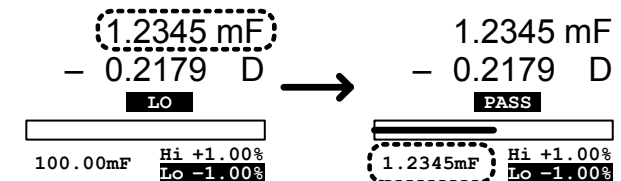
PASS



Use display value as nominal

Panel operation (For Percentage only) The displayed value can be used as the nominal value. Press F6 (Save Nom) to copy the display value to the nominal value.

F 6



Multi-Step Test Configuration

Overview

Background	The multi-step function can configure and run multiple measurement steps. Maximum 64 programs, 30 steps each, can be programmed and stored in the instrument.		
Limit type	Only the absolute limit testing is available. For percentage limit test, use the single mode (page53).	Low Limit	Hi Limit
		← Pass →	
Test item	Cs Series capacitance	X Reactance	
	Cp Parallel capacitance	B Susceptance	
	Ls Series inductance	Z Impedance	
	Lp Parallel inductance	Y Admittance	
	Rs Series resistance	RDC DC Resistance	
	Rp Parallel resistance	θ Angle	
	For detailed description of each item, see page31.		
Parameters	No. of step	Maximum 30 for each program	
	No. of program	Maximum 64	
	Drive Voltage	10mV ~ 2V, 1mV step	
	Frequency	20Hz ~ 1MHz	
	Bias	Reserved item: internal use only	
	Speed	Max, Fast, Med, Slow	
	Hi / Lo Limit	Follows the measurement range	
	Delay	0 ~ 9999ms, 1ms step	
	Single trigger	Program runs when the Trigger key or F1 (Start) is pressed.	
	Automatic trigger	Program runs when LCR-8101 detects the DUT.	

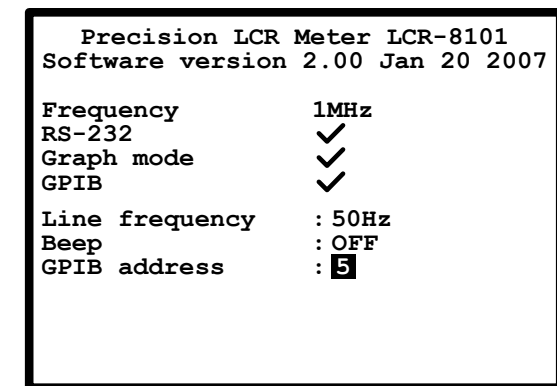
Configure beep setting

Background The beep sounds when the pass/fail test result matches the setting: failed or passed.

- Panel operation**
1. Press the Menu key, then F5 (System). The system configuration appears.

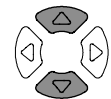


F 5

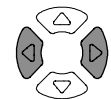


2. Press the Up/Down key and move the cursor to Beep.

Beep : OFF



3. Press the Left/Right key to select the beep setting, Off, Pass, or Fail.



Off Beep is turned Off
 Pass Beeps when the test result is pass
 Fail Beeps when the test result is fail

Enter multi-step mode

Panel operation Press the Menu key, then F3 (Multi Step). The multi-step mode menu appears. The last recalled program appears on the display.

Menu

F 3

MULTI STEP MODE-Set PROGRAM: NONAME			
Step	01	02	03
Func	B	Rdc	OFF
Freq	1.0000k		
Volt	10mV	1.00 V	
Bias			
Spd	MAX	FAST	
Hi	1.0000 S	0.0000Ω	
Lo	500.00mS	0.0000Ω	
Dly	9999 ms	0 ms	

Prog F 1
Copy F 2
Delete F 3
Save F 4
File F 5
RUN F 6

Create new program

Panel operation 1. In the multi-step mode, press F5 (File), then F4 (New). The new program name dialog opens.


F 5


F 4


MULTI STEP MODE-Set PROGRAM: NONAME			
New program name: New_			
0123456789- _			
ABCDEFGHIJKLMNOPQRSTUVWXYZ			
abcdefghijklmnopqrstuvwxyz			
Edit by ↑↓←→ key			
Enter- Confirm, Clear- Quit			
Dly	9999 ms	0 ms	

LOAD F 1
DELETE F 2
Save as F 3
New F 4
QUIT F 6

2. Enter the new program name using the arrow keys.

Move cursor (Left/Right keys)  JKLMNOPQRS

Enter the letter (Down key)  program name: N_

Delete one letter (Up key)  program name: _

3. Press the Enter key to confirm the file name. To quit the new program mode, press the Clear key.



4. A blank program with the entered name appears.

MULTI STEP MODE-Set PROGRAM: New			
Step	01	02	03
Func	OFF	OFF	OFF
Freq			
Volt			
Bias			
Spd			
Hi			
Lo			
Dly			

Prog F 1
Copy F 2
Delete F 3
Save F 4
File F 5
RUN F 6

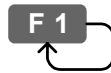
5. Press F1 (Prog). Step 01 becomes active and changes to Ls measurement mode. For further editing details, see the next page.

Step	01	→	Step	01
Func	OFF		Func	Ls

Edit program step

How to edit parameter

- For selecting parameters, press F1 (Prog) repeatedly.
- For entering values, use the numerical and unit keys.



Example:

0.5kHz



Backspace



All clear



Increase

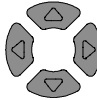


Decrease



How to move cursor

To move the cursor to the editing point, use the arrow keys: up, down, left, and right.



Note: The cursor cannot move into blank columns or steps.

Panel operation
1. Create new step

To create a new step in a program, press F1 (Prog) at Func column "OFF". The step becomes active and the function changes to Ls. Up to 30 steps are available in a program.



Step	01	→	Step	01
Func	OFF		Func	Ls

2. Select item (function)

Move the cursor to Func column, press F1 (Prog) repeatedly. The measurement item (function) changes in the following order.



Ls → Lp → Q → Cs → Cp → D → Z → θ → Rs → Rp → X → G → B → Y → Rdc → Ls

Set frequency

Move the cursor to Freq column.
Enter the frequency using the numerical keys and unit keys.

Func	Ls
Freq	500.00
Volt	2.00 V

Range 20Hz ~ 1MHz, 5 digit resolution

Example:

0.5kHz (500Hz)



Set voltage

Move the cursor to Volt column.
Enter the voltage using the numerical keys and unit keys.

Freq	500.00
Volt	2.00 V
Bias	

Range 10mV ~ 2V, 1mV resolution

Example:

100mV



Select data capture rate

Move the cursor to Spd column.
Select the capture rate by pressing F1 (Prog) repeatedly.

Bias	
Spd	MAX
Hi	1.0000H



Slow 500mS

Med 450mS (AC), 120mS (Rdc)

Fast 150mS (AC), 50mS (Rdc)

Max 75mS (AC), 30mS (Rdc)

Set Hi limit

Move the cursor to Hi column.
Enter the Hi limit using the numerical keys and unit keys.

Spd	MAX
Hi	1.0000H
Lo	0.0000H

Range follows the specification for each measurement item

Example: 1.5kH (for Ls)



Set Lo limit

Move the cursor to Lo column.
Enter the Lo limit using the numerical keys and unit keys.

Spd	MAX
Hi	1.0000H
Lo	0.0000H

Range follows the specification for each measurement item

Example: 1.0kH
(for Ls)



Set trigger delay

Move the cursor to Dly (Delay) column. Enter the amount of trigger delay time using the numerical keys and unit keys.

Hi	1.0000H
Lo	0.0000H
Dly	10 ms

Range 0 (no delay) ~ 1000ms

Example: 10ms



Copy (duplicate) program step

Background

Copying the step inserts a new, identical step next to the current step (= the step where the cursor resides).

Panel operation

Press F2 (Copy). A new step with identical contents appears on the right side.

F 2

Before (step 3 empty)

Step	01	02	03
Func	B	Rdc	OFF
Freq	1.0000k		
Volt	10mV	1.00 V	
Bias			
Spd	MAX	FAST	
Hi	1.0000 S	0.0000Ω	
Lo	500.00mS	0.0000Ω	
Dly	9999 ms	0 mS	

After (step 2 copied to 3)

Step	01	02	03
Func	B	Rdc	Rdc
Freq	1.0000k		
Volt	10mV	1.00 V	1.00 V
Bias			
Spd	MAX	FAST	FAST
Hi	1.0000 S	0.0000Ω	0.0000Ω
Lo	500.00mS	0.0000Ω	0.0000Ω
Dly	9999 ms	0 mS	0 mS

Delete program step

Background

Deleting the step deleted the currently selected step (= where the cursor resides). The other step numbers are decreased by 1 (shifted to the left in the table).

Panel operation

Press F3 (Delete). The current step is deleted, and the whole table shifts to the left.

F 3

Before (step 2 deleted)

Step	01	02	03
Func	B	G	Rdc
Freq	1.0000k		
Volt	10mV	1.20 V	1.00 V
Bias			
Spd	MAX	MED	FAST
Hi	1.0000 S	1.5000kS	0.0000Ω
Lo	500.00mS	0.0000S	0.0000Ω
Dly	9999 ms	10 mS	0 mS

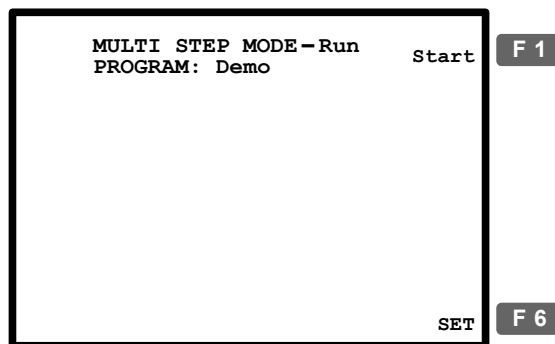
After (step 3 becomes 2)

Step	01	02	03
Func	B	Rdc	OFF
Freq	1.0000k		
Volt	10mV	1.00 V	
Bias			
Spd	MAX	FAST	
Hi	1.0000 S	0.0000Ω	
Lo	500.00mS	0.0000Ω	
Dly	9999 ms	0 mS	

Multi-Step Program Run

Run program

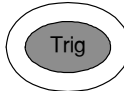
- Panel operation 1. When editing is completed, press F6 (Run) to run the multi-step program. The display changes to program running mode.



2. Press the Sing/Rep key to select Single (manual trigger) or Repetitive (automatic trigger).

Manual trigger

Manual trigger



Starts running the program when the Trigger key or F1 (Start) is pressed.

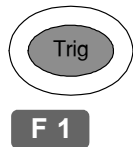
F 1

Auto trigger

Auto trigger

Starts running the program when LCR-8101 detects the DUT is connected to the fixture (scans the fixture continuously). Manual triggering is also available.

3. Press F1 (Start) or the Trigger key to manually start the program. The test results show up according to the program contents.



MULTI STEP MODE-Run					
PROGRAM: Demo					Start
Freq	Volt		Result		
1 1.2000k	1.00	Ls	9.8936mH	LO	
2 10.000k	1.00	Q	22.708 Q	PASS	
3 100.00k	1.00	Ls	10.852mH	HI	
4 DC	1.00	Rdc	25.555 Ω	PASS	
FAIL					SET

The rightmost row shows the result for each step.

LO Failed: below the Lo limit

HI Failed: above the Hi limit

PASS Passed

The left bottom corner shows the result for the whole program.

PASS All steps passed

FAIL One or more steps failed

4. To return to the program setting menu, press F6 (Set).

F 6

Multi-Step Program File Operation

Save program

Save (overwrite) Press F4 (Save) to save the program being edited. A confirmation message appears on the display.

F 4

Program saved

Save as (new program) 1. Press F5 (File), then F3 (Save As). The new program name dialogue appears.

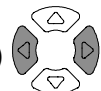
F 5

F 3

MULTI STEP MODE-Set PROGRAM: NONAME				LOAD	F 1
Save program as: New_				DELETE	F 2
0123456789_				Save as	F 3
ABCDEFGHIJKLMNOPQRSTUVWXYZ				New	F 4
abcdefghijklmnopqrstuvwxyz					
Edit by ↑↓←→ key					
Enter- Confirm, Clear- Quit					
Dly 9999 ms 0 ms				QUIT	F 6

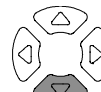
2. Enter the new program name using the arrow keys.

Move cursor
(Left/Right keys)



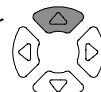
JKLMNOPQRS

Enter the letter
(Down key)



program name: N_

Delete one letter
(Up key)



program name: _

3. Press the Enter key to confirm the file name. To quit the Save as mode, press the Clear key.

Enter

Clear

4. The display goes back to the previous mode, with the program changed to the new name.

MULTI STEP MODE-Set PROGRAM: NEW				Prog
Step	01	02	03	Copy
Func	B	Rdc	OFF	
Freq	1.0000k			Delete
Volt	10mV	1.00 V		
Bias				Save
Spd	MAX	FAST		
Hi	1.0000 S	0.0000Ω		File
Lo	500.00ms	0.0000Ω		
Dly	9999 ms	0 ms		RUN

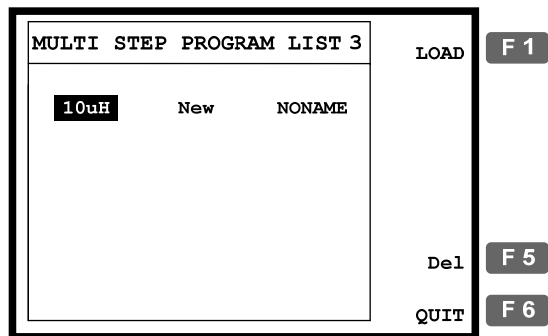
Recall (load) existing program

Panel operation 1. Press F5 (File). The file menu appears.

F 5

2. Press F1 (Load). The existing programs appear, listed in alphabetical order.

F 1



3. Use the arrow key to move the cursor to the program to be recalled (loaded).



4. Press F1 (Load) to recall the selected program on the display.

F 1

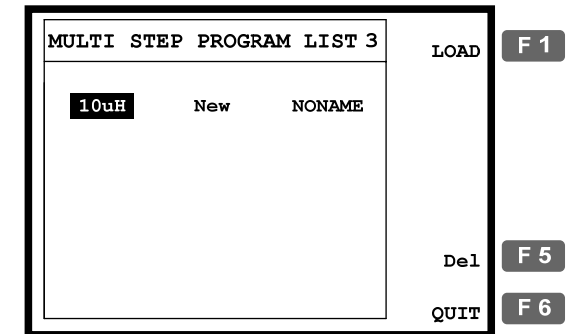
5. To cancel loading and go back to the previous menu, press F6 (Quit).

F 6

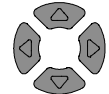
Delete existing program

Recall program 1. Press F5 (File), then F2 (Delete). The existing programs appear, listed in alphabetical order.

F 5

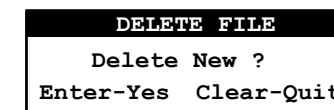
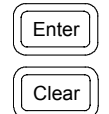


2. Use the arrow key to move the cursor to the program to be deleted.

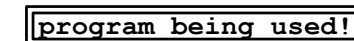


3. Press F5 (Del). The buzzer beeps and a warning sign appear. Press the Enter key (confirm) or the Clear key (cancel).

F 5



Note: the currently active program cannot be deleted. An error message appears.



4. To go back to the previous menu without deleting any program, press F6 (Quit).

F 6

G GRAPH MODE

The graph function shows the component characteristics in visual manner. Voltage and Frequency sweep are selectable for the horizontal scale. When the graph gets out of the vertical range, LCR-8101 can automatically adjust the scale. Marker operation is available for detailed observation.

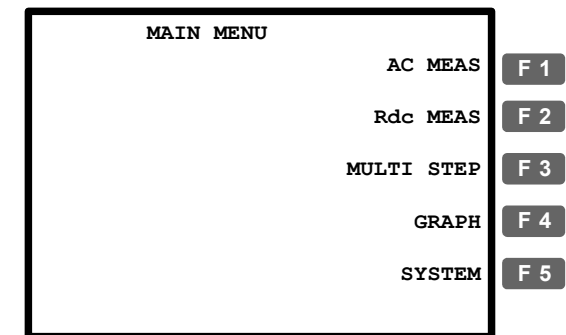
Graph item	Enter graph mode	76
	Select measurement item	77
Horizontal scale	Set horizontal axis (Voltage)	78
	Set horizontal axis (Frequency)	80
Vertical scale	Set vertical axis (Manual + Absolute)	82
	Set vertical axis (Manual + Percentage)	84
	Set vertical axis (Auto + Absolute)	86
	Set vertical axis (Auto + Percentage)	87
Speed/Step	Select measurement speed (capture timing) ...	89
	Select step size	89
Run	Run measurement	90
	Adjust vertical scale	92
	Observe Graph Data	93

Item Selection

Enter graph mode

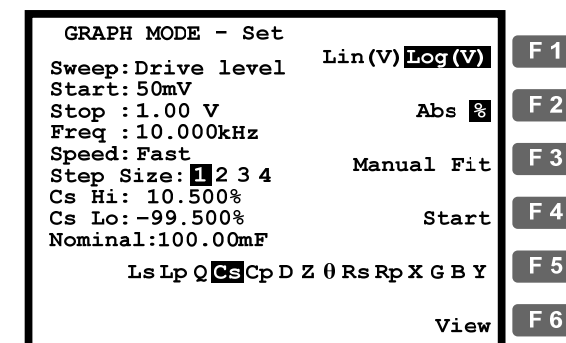
- Panel operation 1. Press the Menu key. The main menu appears.

Menu



2. Press F4 (Graph). The Graph mode display appears.

F 4



Select measurement item

Range	Ls	Series inductance	θ	Angle
	Lp	Parallel inductance	Rs	Series resistance
	Q	Quality factor	Rp	Parallel resistance
	Cs	Series capacitance	X	Reactance
	Cp	Parallel capacitance	G	Conductance
	D	Dissipation factor	B	Susceptance
	Z	Impedance	Y	Admittance

For detailed description of each item, see page31.

Panel operation Press F5 repeatedly to select the graph measurement item.

F 5

Ls Lp Q Cs Cp D Z θ Rs Rp X G B Y

Horizontal Scale Setting

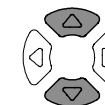
Set horizontal axis (Voltage)

Background The X (horizontal) axis is selectable from Voltage and Frequency sweep.

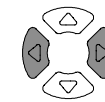
- When Voltage sweep is selected: measurement Frequency is fixed
- When Frequency sweep is selected: measurement Voltage is fixed

Select Drive level (Voltage) 1. Press the Up/Down key and move the cursor to Sweep.

Sweep: Frequency



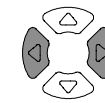
2. If necessary, press the Left/Right key to change the sweep setting to Voltage (Drive Level).



Frequency → Drive Level

Set start Voltage 3. Press the Up/Down key and move the cursor to Start.

Start: 50mV



Use the numerical keys to enter the starting Voltage.

Range 50mV ~ 2V, 1mV resolution

100mV **1** **0** **0** **m** **V/A** **Enter**

1V **1** **V/A** **Enter**

Backspace



All clear

Clear

Increase



Decrease



If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

Nearest Available

If the entered start Voltage level is higher than the stop Voltage, the two values are swapped.

Hi and Lo Swapped

- Set stop Voltage 4. Repeat the above step for the stop Voltage.
Stop: 1.00 V
- Range 50mV ~ 2V, 1mV resolution (stop Voltage must be higher than the start Voltage)

- Set measurement Frequency 5. Use the Up/Down key to move the cursor to Frequency setting (Freq).
Freq : 10.000kHz
- Use the numerical keys to enter the measurement frequency.

Range 20Hz ~ 1MHz

50Hz **5** **0** **Enter**

1MHz **1** **M** **Enter**

Backspace

All clear

Clear

Increase

Decrease

- Select Lin/Log scale 6. Press F1 to select the horizontal scale, Linear or Logarithmic.

Lin (V) **Log (V)**

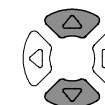
F 1

Set horizontal axis (Frequency)

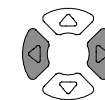
- Background The X (horizontal) axis is selectable from Voltage and Frequency sweep.
- When Voltage sweep is selected: measurement Frequency is fixed
 - When Frequency sweep is selected: measurement Voltage is fixed

- Select Frequency 1. Press the Up/Down key and move the cursor to Sweep.

Sweep: Drive Level



2. If necessary, press the Left/Right key to change the sweep setting to Voltage (Drive Level).

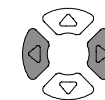


Drive Level → **Frequency**

- Set start Frequency

3. Press the Up/Down key and move the cursor to Start.

Start: 20.000Hz



Use the numerical keys to enter the starting Frequency.

Range 20Hz ~ 1MHz (start Frequency must be higher than the stop Frequency)

50Hz **5** **0** **Enter**

1.2kHz **1** **.** **2** **k** **Enter**

Backspace

All clear

Clear

Increase

Decrease

If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

Nearest Available

If the entered start Voltage level is higher than the stop Voltage, the two values are swapped.

Hi and Lo Swapped

Set stop
Frequency

4. Repeat the above step for the stop Frequency.

Stop: 1.00 V

Range 20Hz ~ 1MHz (stop Frequency must be higher than the start Frequency)

Set measurement
Voltage

5. Use the Up/Down key to move the cursor to Voltage setting (Level).

Level: 1.00 V

Use the numerical keys to enter the measurement Voltage.

Range 10mV ~ 2V

100mV

1V

Backspace  All clear

Increase  Decrease 

Select Lin/Log
scale

6. Press F1 to select the horizontal scale, Linear or Logarithmic.

Lin (Hz) Log (Hz)

F 1

Vertical Scale Setting

Set vertical axis (Manual + Absolute)

Background

The Y (vertical) axis configuration is available for:

- Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted.
- Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.

Panel operation

1. Press F2 to select Abs.

F 2

Abs %

2. Press F3 to select Manual Fit.

F 3

Manual Fit

3. The maximum (Hi) and minimum (Lo) level of the vertical axis appears.

Step Size: 1 2 3 4

Cs Hi: 5.8240mF

Cs Lo: 3.5626mF

Set Hi level

4. Press the Up/Down key to move the cursor to Hi level.

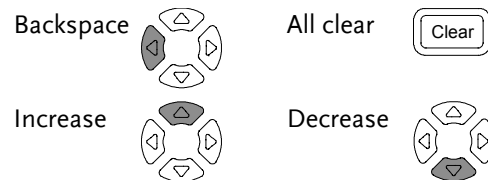
Cs Hi: 5.8240mF

5. Use the numerical keys to enter the Hi level.

Range According to each measurement item (see page31).

1.2mΩ

1.5kH



If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

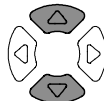
Nearest Available

If the entered start Voltage level is higher than the stop Voltage, the two values are swapped.

Hi and Lo Swapped

Set Lo level

6. Press the Up/Down key to move the cursor to Lo level and repeat the same step.



Cs Lo: **3.5626mF**

Set vertical axis (Manual + Percentage)

Background	<p>The Y (vertical) axis configuration is available for:</p> <ul style="list-style-type: none"> Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted. Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.
------------	---

- Panel operation 1. Press F2 to select % (Percentage).

F 2

Abs %

2. Press F3 to select Manual Fit.

F 3

Manual Fit

3. The Hi percentage, Lo percentage, and the nominal value of the vertical axis appear.

Step Size: 1 2 4 8

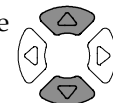
Cs Hi: 10.500%

Cs Lo: -19.500%

Nominal: 100.00mF

Set Hi level

4. Press the Up/Down key to move the cursor to Hi percentage.



Cs Hi: 10.500%

5. Use the numerical keys to enter the percentage.

Range -1.0×10^{12} (Tera) $\sim 1.0 \times 10^{12}$ (Tera) %

50% **5 0 Enter**

1200% **1 . 2 k Enter**



Increase



Decrease



If a wrong unit is entered, the value is cancelled.

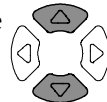
Unit Mismatched

If the entered Hi level is lower than the Lo level, the two values are swapped.

Hi and Lo Swapped

Set Lo level

6. Press the Up/Down key to move the cursor to Lo percentage and repeat the same step.

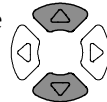


Cs Lo: -19.500%

Range -1.0×10^{12} (Tera) ~ 1.0×10^{12} (Tera) %

Set Nominal

7. Press the Up/Down key to move the cursor to Nominal.



Nominal: 1.0000mF

8. Use the numerical keys to enter the nominal value on which the Hi and Lo percentages are based.

Range According to each measurement item (see page31).

1.2mΩ 1 . 2 m Ω Enter

1.5kH 1 . 5 k H Enter

Backspace



All clear



Increase



Decrease



If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

Nearest Available

Set vertical axis (Auto + Absolute)

Background

The Y (vertical) axis configuration is available for:

- Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted.
- Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.

Panel operation

1. Press F2 to select Abs (Absolute).

F 2

Abs %

2. Press F3 to select Auto Fit.

F 3

Auto Fit

3. Nothing new appears on the display: LCR-8101 automatically configures the vertical scale according to the measured data.

Step Size: 1 2 4 8



Set vertical axis (Auto + Percentage)

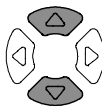
Background The Y (vertical) axis configuration is available for:

- Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted.
- Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.

- Panel operation
- Press F2 to select % (Percentage). **F 2**
Abs %
 - Press F3 to select Auto Fit. **F 3**
Auto Fit
 - The nominal value appears on the display.
Step Size: 1 2 4 8
Nominal: 1.0000mF

- Set Nominal level
- Press the Up/Down key to move the cursor to Nominal.

Nominal: 1.0000mF

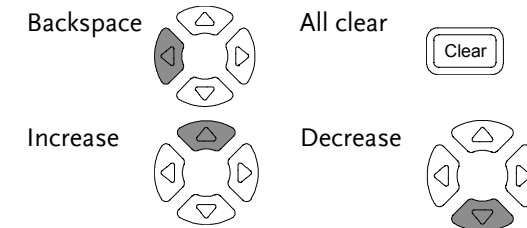


- Use the numerical keys to enter the nominal value on which the Hi and Lo percentages are based.

Range According to each measurement item (see page31).

1.2mΩ **1** **.** **2** **m** **Ω** **Enter**

1.5kH **1** **.** **5** **k** **H** **Enter**



If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

Nearest Available

- LCR-8101 automatically configures the percentage (below and above the nominal level) of the vertical scale.

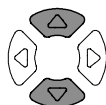
Speed / Step Setting

Select measurement speed (capture timing)

Background The speed is the same setting used in the basic measurement (page50), except in the graph mode, maximum speed setting is not available.

- Panel operation** 1. Press the Up/Down key and move the cursor to Speed.

Speed: **Fast**



2. If necessary, press the Left/Right key to change the setting (time per capture).



Slow 500mS

Med 450mS (AC), 120mS (Rdc)

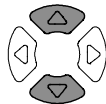
Fast 150mS (AC), 50mS (Rdc)

Select step size

Background The step size selects whether to plot every captured data (step size 1) or to plot only the selected data (step size 2, 4, 8 = every 2, 4, 8 data).
Step size 1: detailed graph, slow capturing
Step size 2, 4, 8: simplified graph, fast capturing

- Panel operation** 1. Press the Up/Down key and move the cursor to Step size.

Step Size: **1 2 4 8**



2. If necessary, press the Left/Right key to change the setting.



Range 1 (plot all data), 2, 4, 8

Running Graph Measurement

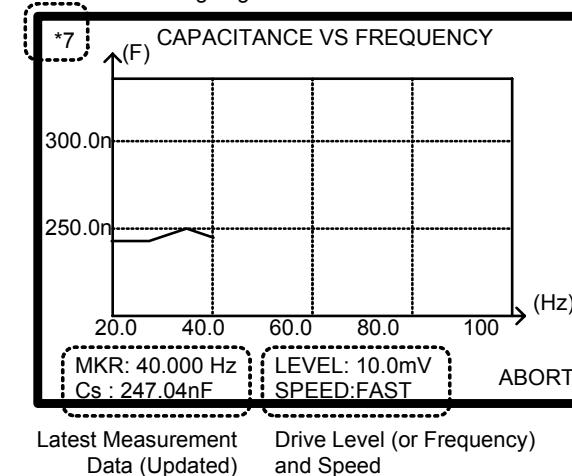
Run measurement

- Panel operation** 1. When the configuration is completed, press F4 (Start) to start the graph measurement.

F 4

2. The display changes into graph mode and starts plotting the measurement data.

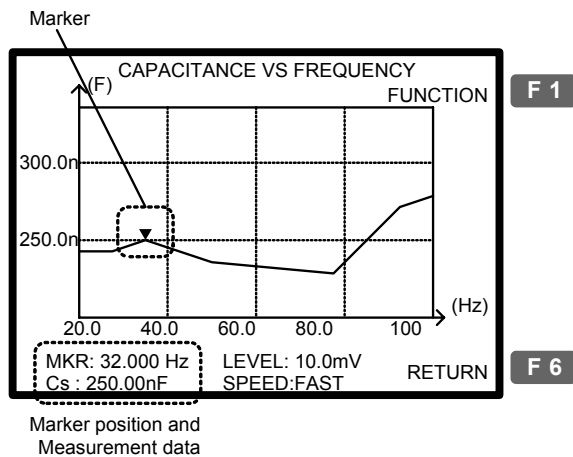
Measurement Ongoing



3. To abort the measurement, press F6 (Abort).

F 6

4. When completed, the buzzer sounds once and the display shows the whole plotted data.



5. To go back to the configuration mode, press F6 (Return).

F 6

Adjust vertical scale

Background

When the measured data does not fit into the original vertical scale, use this function so that LCR-8101 automatically adjust the scale to include the whole plotted data.

Panel operation

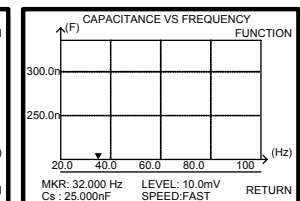
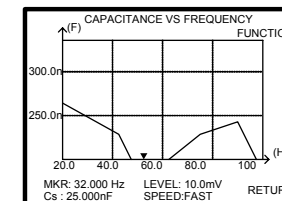
1. If part or all of the plotted data are out of the vertical range, use the automatic fit function. Press F1 (Function), then F2 (Fit).

F 1

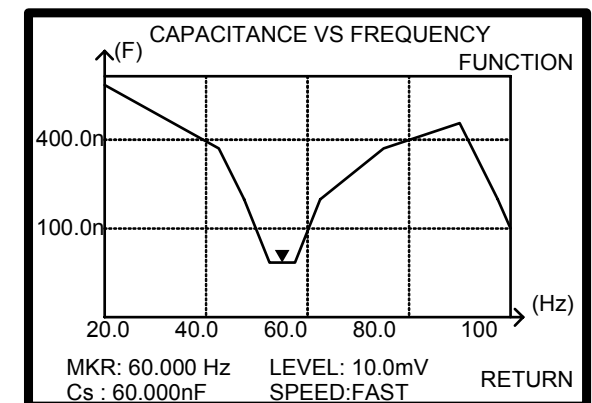
F 2

(Partially out of range)

(Totally out of range)



2. The vertical range is automatically adjusted to include the whole plotted data.

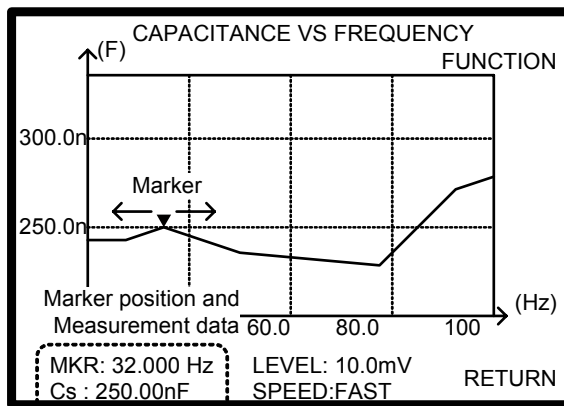


Observe Graph Data

Background When the graph is completed (page90) and the vertical scale is adjusted (page92), use the marker to observe the measurement data in detail.

In the configuration mode, if the graph is already available, it can be viewed by pressing F6 (View).

- Panel operation**
1. To move the marker, press the Left/Right key. As the marker moves, the marker position and measurement data changes.



- Move marker to the peak**
2. To move the marker to the peak of the plot, press F1 (Function) and F3 (Peak). Press F1 (View) to go back to the previous display.

- Move marker to the bottom**
3. To move the marker to the bottom of the plot, press F1 (Function) and F4 (Dip). Press F1 (View) to go back to the previous display.

REMOTE CONTROL

This chapter describes basic aspects of IEEE488.2 based remote control. Both RS-232C and GPIB interface can be used for remote control. For more details such as full length command, refer to the programming manual downloadable from GWInstek website, www.gwinstek.com.tw.

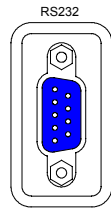
Configuration	Configure RS-232C interface	95
	Configure GPIB interface	96
Command syntax	Command Syntax	98
Command set	System command	99
	Measurement command	100
	Multi-step program command	102
	Calibration command	104

Interface Configuration

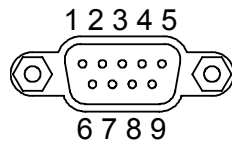
Configure RS-232C interface

RS-232C configuration	Connector	DB-9, Male
	Baud rate	9600
	Parity	None
	Data bit	8
	Stop bit	1

Connect the RS-232C cable to the rear panel port: DB-9 male connector.

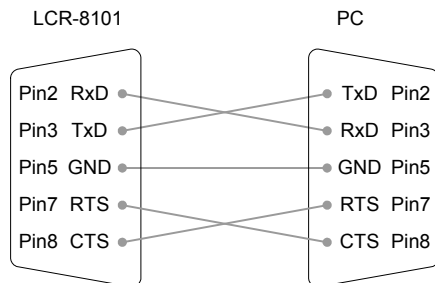


Pin assignment



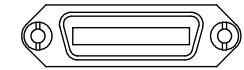
2: RxD (Receive data)
 3: TxD (Transmit data)
 5: GND
 7: RTS (Request to send)
 8: CTS (Clear to send)
 4, 6, 9: No connection

PC connection Use the Null Modem connection as in the below diagram.

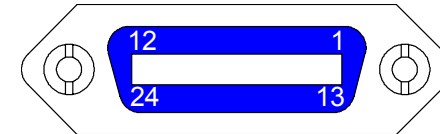


Configure GPIB interface

Connection Connect the GPIB cable to the rear panel port: 24-pin female connector.



Pin assignment



Pin1	Data line 1	Pin13	Data line 5
Pin2	Data line 2	Pin14	Data line 6
Pin3	Data line 3	Pin15	Data line 7
Pin4	Data line 4	Pin16	Data line 8
Pin5	EOI	Pin17	REN
Pin6	DAV	Pin18	Ground
Pin7	NRFD	Pin19	Ground
Pin8	NDAC	Pin20	Ground
Pin9	IFC	Pin21	Ground
Pin10	SRQ	Pin22	Ground
Pin11	ATN	Pin23	Ground
Pin12	Shield (screen)	Pin24	Signal ground

- GPIB constraints
- Maximum 15 devices altogether, 20m cable length, 2m between each device
 - Unique address assigned to each device
 - At least 2/3 of the devices turned On
 - No loop or parallel connection

Select GPIB
address

1. Press the Menu key and F5 (System).
The system configuration appears.

Menu

F 5

```

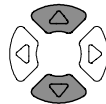
Precision LCR Meter LCR-8101
Software version 2.00 Jan 20 2007

Frequency          1MHz
RS-232             ✓
Graph mode         ✓
GPIB               ✓

Line frequency     : 50Hz
Beep               : OFF
GPIB address       : 5
  
```

2. Press the Up/Down key and move
the cursor to GPIB.

GPIB address : 5



3. Use the numerical keys to enter the GPIB
address, 1 ~ 30.

GPIB address : 30

Address 5 5 Enter

Command Syntax

Compatible
standard

- IEEE488.2, 1992 (fully compatible)
- SCPI, 1994 (partially compatible)

Command format

trig:del:mod <NR1>LF

1: command header
2: single space
3: parameter
4: message terminator

Parameter	Type	Description	Example
	<Boolean>	boolean logic	0, 1
	<NR1>	integers	0, 1, 2, 3
	<NR2>	decimal numbers	0.1, 3.14, 8.5
	<NR3>	floating point	4.5e-1, 8.25e+1
	<disc>	discrete data	on, off, max

Message
terminator

Terminates a command line. Note that LCR-8101
accepts only LF (line feed) as the terminator.



LF line feed code

Note

- Commands introduced here are described in abbreviated style (same functionality)
- Commands are non-case sensitive.

Command Set

System command

*cls	Clears the Event Status Register and associated status data structure.
*ese <NR1> *ese?	Sets or returns the current contents of the Standard Event Status Enable Register as an integer in the range 0 to 255.
*esr?	Returns the current contents of the Standard Event Status Register as an integer in the range 0 to 255. It also clears ESR.
*idn?	Returns oscilloscope ID as Manufacturer, Model No, Serial No, Firmware version. Example: GW INSTEK, 8101, 0, 1.84
*loc	Sets the instrument to local state.
*opc	Sets the OPC bit of the ESR register.
*opc?	Always returns 1 as instrument commands are always processed sequentially.
*opt?	Returns the hardware options installed in the instrument. Example: 1MHz, GPIB, RS232, GRAPH MODE
*rst	Resets LCR-8101.
*sre <NR1> *sre?	Sets or returns the current contents of the Service Request Enable Register as an integer in the range 0 to 63 and 128 to 255.
:stat:oper:con?	Reads Status Operation Condition register.
:stat:oper:enab <NR1>	Sets Status Operation Enable register.
:stat:oper:even?	Reads Status Operation Event register.

*stb?	Returns the current contents of the Status Byte with the Master Summary bits as an integer in the range 0 to 255. Bit 6 represents Master Summary Status rather than Request Service.
*trg	Triggers a direct measurement, but does not return the results to the controller. This is the same as a GET (Group Execute Trigger) command.
*wai	Command has no effect as commands are processed sequentially.

Measurement command

:dump-bmp	Returns the display as a windows compatible bitmap.
:beep <disc> :beep?	Sets or returns the buzzer condition. Set parameter: off (disabled), pass (beeps when passed), fail (beeps when failed) Return parameter: 0 (off), 1 (pass), 2 (fail)
:loc-trig <NR1>	Turns On/Off local triggering in remote control Parameter: on (local control), off (remote control)
:meas:equ-cct <NR1> :meas:equ-cct?	Selects or returns equivalent circuit. Send parameter: ser, par Return parameter: 0 (parallel), 1 (series)
:meas:freq <NR3> :meas:freq?	Sets or returns frequency of AC measurement in Hz. Parameter example: (1kHz) 1k, 1000 Hz, 1E3
:meas:func <disc>	Selects first or second AC measurement function. Parameter: c, l, x, b, z, y, q, d, r, g Example: :meas:func:c;d (C+D measurement)
:meas:func:major ?	Returns the first AC function. Parameter: 0 (C), 1 (L), 2 (X), 3 (B), 4 (Z), 5 (Y)

:meas:func:minor ?	Returns the second AC function. Parameter: 0 (Q), 1 (D), 2 (R), 3 (G) If the first function is Z or Y, this command returns the last non-polar setting
:meas:hi-lim <NR2> :meas:hi-lim?	Sets or returns scale high limit as percentage. Example: :meas:hi-lim 5.0 (+5.0%)
:meas:lev <NR2> :meas:lev?	Sets or returns drive level for currently selected test. Parameter example: (200mV) 0.2V, 200m
:meas:limit <disc> :meas:limit?	Sets or returns percentage or absolute scale limits. Send parameter: abs (absolute), perc (percentage) Return parameter: 0 (absolute), 1 (percentage)
:meas:lo-lim <NR2> :meas:lo-lim?	Sets or returns scale low limit as percentage. Example: :meas:hi-lim -5.0 (-5.0%)
:meas:nom <NR3> :meas:nom?	Sets or returns nominal value for scale. Send parameter: according to the active unit (1e-6f = 1uF) Return parameter example: .10000000e-1 = 10mH
:meas:range <NR1> :meas:range?	Selects or returns auto-ranging or range-hold on range N. Send parameter: auto, hold, 1 ~ 7 Return parameter: 0 (auto), 1 ~ 7
:meas:scale <disc> :meas:scale?	Shows or hides the scale bar or returns the status. Send parameter: on, off Return parameter: 0 (scale hidden), 1 (scale visible)
:meas:speed <disc> :meas:speed?	Selects or returns measurement speed. Send parameter: max, fast, med, slow Return parameter: 0 (max), 1 (fast), 2 (med), 3 (slow)

:meas:test:ac	Selects AC measurement.
:meas:test:rdc	Selects Rdc measurement.
:meas:test?	Returns measurement type. Parameter: 0 (AC measurement), 1 (Rdc measurement)
:meas:trig	Triggers an AC or Rdc measurement manually. Returns the 1 st and 2 nd measurement (only the 1 st in Rdc). Example: -396.283E-6, 99.558 (uF/D)
:mode?	Query the currently selected operating mode.
:rep <disc> :rep?	Enables or returns repetitive measurements when unit is returned to local control. Send parameter: on (repetitive), off (single shot) Return parameter: 0 (single shot), 1 (repetitive) Example: :rep on (repetitive mode)
:trig	Triggers a measurement in the current mode.

Multi-step program command

:multi:set	Switches to the multi-step set-up page.
:multi:del	Removes a step in the program. Parameter: 1 ~ 30 Example: :multi:del 2 (deletes step 2)
:multi:delay <NR2> :multi:delay?	Sets or returns trigger delay time for currently selected step in millisecond. Parameter: 0ms ~ 1000ms Example: :multi:delay 10m (10ms)
:multi:freq <NR2> :multi:freq?	Sets or returns the frequency for the currently selected step in Hz. Parameter: 20 ~ 1MHz Example: :multi:freq 1e3 (1kHz)

:multi:func <NR1>	Sets or returns measurement type for the currently selected step.
:multi:func?	Send parameter: LS, LP, Q, CS, CP, D, Z, PHASE, RS, RP, X, G, B, Y, RDC Return parameter: 1 (Z), 2 (Ls), 3 (Lp), 4 (Cs), 5 (Cp), 7 (Y), 8 (G), 9 (P), 10 (Q), 11 (D), 12 (Rs), 13 (Rp), 14 (B), 15 (X), 16 (Rdc) Example: :multi:func ls (Series inductance)
:multi:hi-lim <NR3>	Sets or returns the higher test limit of the currently selected step.
:multi:hi-lim?	Example: :multi:hi-lim 10 (limit to 10.0)
:multi:lev <NR3> :multi:lev?	Sets or returns the drive level for the currently selected step in Voltage. Parameter: 10mV ~ 2V Example: :multi:lev 200m (200mV)
:multi:load <filename>	Loads an existed file to run or edit. Example: :multi:load demo (file name demo)
:multi:lo-lim <NR3>	Sets or returns the lower test limit of the currently selected step.
:multi:lo-lim?	Example: :multi:lo-lim -5 (limit to -5)
:multi:new <filename>	Create a new multi-step program. Example: :multi:new demo (file name demo)
:multi:res?	Query the results of the test for each step. Parameter: 0 (Pass), 1 (Fail Hi), 2 (Fail Lo) Example: 1, +1.5E-7, 0, -0.2E-4 (step 1 failed on high limit, step 2 passed)
:multi:run	Switches to the multi-step run page.
:multi:save	Save currently edited file.

:multi:speed <disc>	Sets or returns the measurement speed for the currently selected step.
:multi:speed?	Send parameter: Max, Fast, Med, Slow Return parameter: 0(Max), 1(Fast), 2(Med), 3(Slow) Example: :multi:speed max (maximum speed)
:multi:test <NR1>	Selects or returns the step being edited.
:multi:test?	Parameter: 1 ~ 30 Example: :multi:test 1(step 1 selected)
:multi:trig	Starts running multi-step measurements.

Calibration command

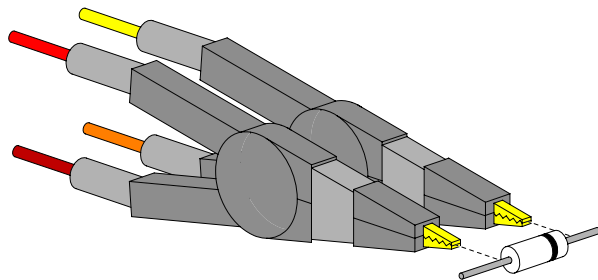
:cal:oc-trim <NR1>	Performs open circuit trimming. Parameter: 1 (Spot trim), 2 (<10kHz), 3 (<100kHz), 4 (All frequency) Example: :cal:oc-trim 4 (calibrate for all frequency)
:cal:sc-trim <NR1>	Performs short circuit trimming. Parameter: 1 (Spot trim), 2 (<10kHz), 3 (<100kHz), 4 (All frequency), 5 (Rdc) Example: :cal:sc-trim 4 (calibrate for all frequency)
:cal:res?	Returns the result of the calibration performed. Parameter: 0 (fail), 1 (pass)

CALIBRATION

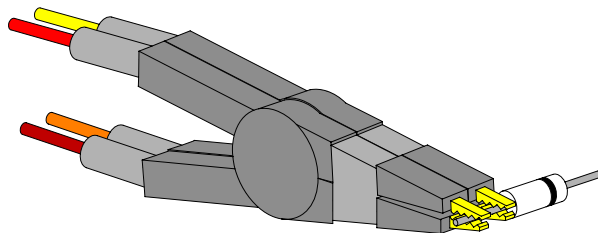
Overview

Background Calibration (trimming) eliminates stray capacitance and series impedance from the testing fixture. It is required when using the instrument in a new environment, or using a new set of testing fixtures.

O/C trimming The testing fixture clips are separated by a distance equal to the normal testing position.



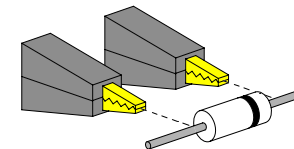
S/C trimming The testing fixture clips are connected by a piece of wire or a component lead (but no direct connection between the clips).



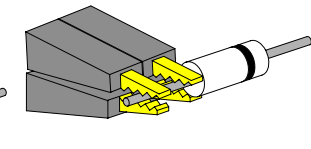
Trim LCR-8101

Fixture setting Prepare the fixture accordingly. (In order to run a complete trimming, both O/C and S/C trimming have to be done.)

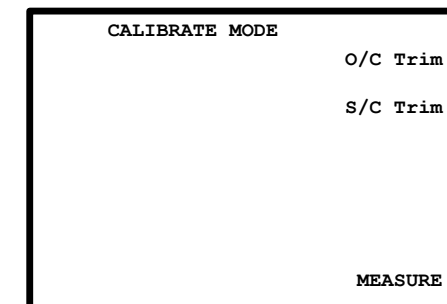
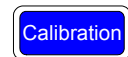
O/C trimming



S/C trimming



Panel operation 1. Press the Calibration key. The calibration mode menu appears.

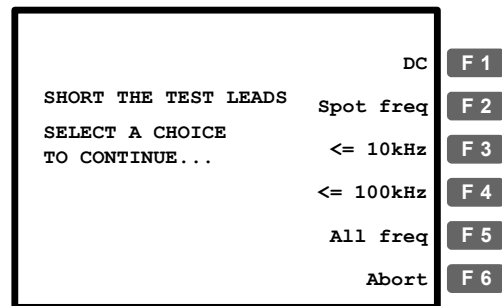


* To go back to the measurement mode, press F6 (MEASURE).

2. Press F1 (O/C Trim) or F2 (S/C Trim) to select the trimming mode.

3. The trimming menu appears.

S/C trimming



4. Always select F5 (All freq) when using the standard fixture set included in LCR-8101 package.

F 5

DC (S/C trimming only) Trims at 0Hz.

Spot freq Trims at the frequency set in the measurement mode (page30).

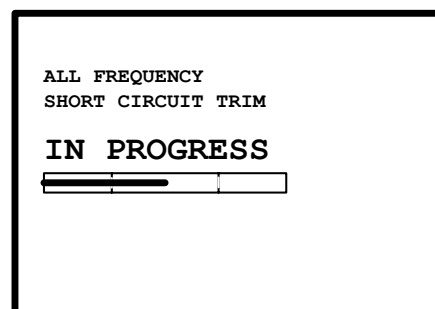
<= 10kHz Frequency range is 0Hz ~ 10kHz.

<= 100kHz Frequency range is 0Hz ~ 100kHz.

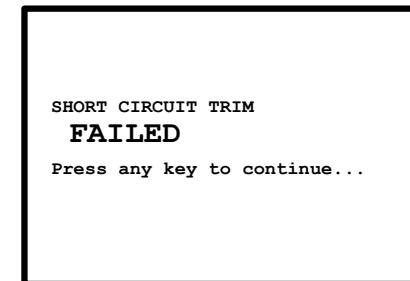
All freq Frequency range is 0Hz ~ 1MHz.

Frequency limit example: When using a special fixture set, trimming failed at 50kHz which is outside of the test component range (up to 5kHz). In this case, use F3 (<= 10kHz).

5. The trimming starts and ends automatically.



- Trim pass The display goes back to the calibration mode menu.
- Trim fail The Fail message appears on the display. Press any other key to go back to the original menu.



6. Switch the fixture setting from O/C to S/C (or from S/C to O/C) and repeat from step 1.

FAQ

Q1. The beep keeps sounding.

A1. The beep sounds according to the pass/fail test result, which in this case is set to repetitive mode. Do one of the following.

- Set the test mode to Single (manual trigger), so that the beep sounds only when the test is initiated manually. Press the Sing/Rep key to change the setting. For details, see page49.
- Turn Off the beep entirely. Press the Menu key, F5 (System), move the cursor to Beep and select Off using the arrow keys. For details, see page54.

Q2. Panel operation seems disabled.

A2. Panel (local) operation is disabled in the Remote control mode (page94). Press the Local key to bring back the instrument to local operation mode (remote control is cancelled).

Q3. I cannot see the display clearly.

A3. Use the display contrast knob on the rear panel to adjust the brightness.

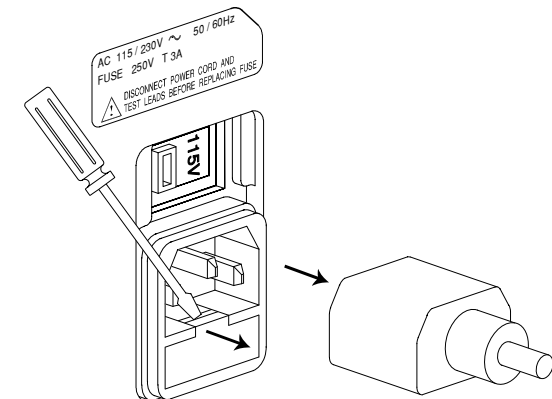
For more information, contact your local dealer or GWInstek at www.gwinstek.com.tw / marketing@goodwill.com.tw.

APPENDIX

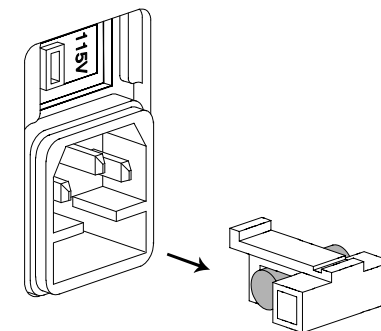
Fuse Replacement

Step

1. Take off the power cord and remove the fuse socket using a minus driver.



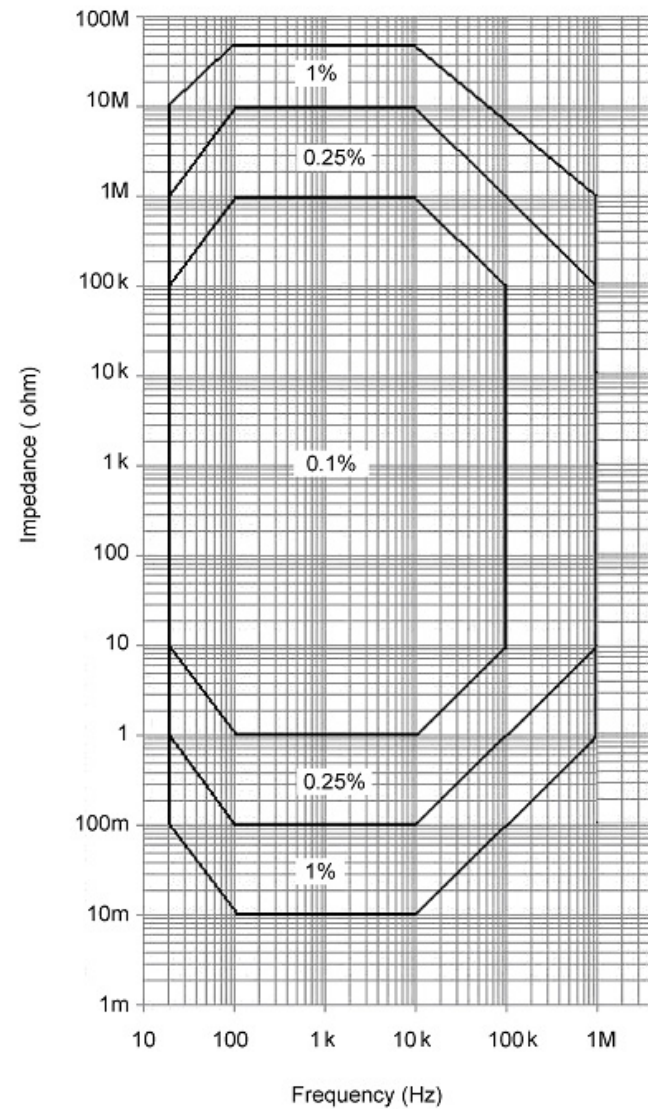
2. Replace the fuse in the holder.



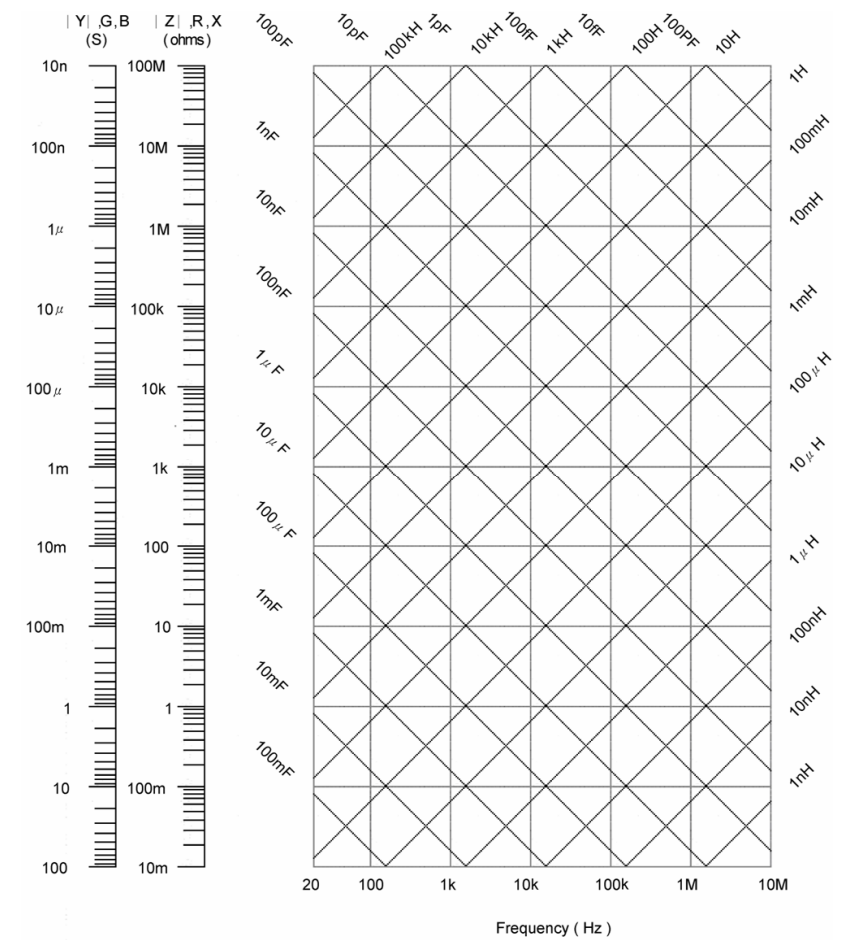
Rating

T3A/250V

|Z| Accuracy Chart



|Z| vs L, C Chart



Accuracy Definition

Z , Y	High Impedance	$Ae[\%]=\pm((A+0.0000001*Z_x)*K_v*K_t)$			
	Low Impedance	$Ae[\%]=\pm((A+0.1/Z_x)*K_v*K_t)$			
L, C, X, B	High Impedance when $D < 0.1$				
	$Ae[\%] = \pm ((A + 0.0000001*Z_x) * K_v * K_t)$				
	High Impedance when $D \geq 0.1$				
	$Ae[\%] = \pm (((A + 0.0000001*Z_x) * K_v*K_t)*\sqrt{(1+D^2)})$				
	Low Impedance when $D < 0.1$				
	$Ae[\%] = \pm ((A + 0.1/Z_x) * K_v * K_t)$				
	Low Impedance when $D \geq 0.1$				
	$Ae[\%] = \pm (((A + 0.1/Z_x) * K_v * K_t) * \sqrt{(1+D^2)})$				
R, G	High Impedance when $Q_x < 0.1$				
	$Ae[\%] = \pm ((A + 0.0000001*Z_x) * K_v * K_t)$				
	High Impedance when $Q_x \geq 0.1$				
	$Ae[\%] = \pm (((A + 0.0000001*Z_x) * K_v*K_t)*\sqrt{(1+Q^2)})$				
	Low Impedance when $Q_x < 0.1$				
	$Ae[\%] = \pm ((A + 0.1/Z_x) * K_v * K_t)$				
	Low Impedance when $Q_x \geq 0.1$				
	$Ae[\%] = \pm (((A + 0.1/Z_x) * K_v * K_t) * \sqrt{(1+Q^2)})$				
D	$\pm (Ae/100)$ when $D \leq 0.1$				
	$\pm ((Ae/100) * (1+D^2))$ when $D > 0.1$				
Q	$\pm (((Q_x^2*De) / (1\pm Q_x*De))$ when $(Q_x*De) < 1$				
Convention	A	Accuracy taken from the Accuracy chart			
	Zx	Measured value of unknown component			
	Kv	Test Voltage factor			
		Level	Kv	Level	Kv
		≥ 1.250	1.2	≥ 0.078	2
		≥ 0.625	1	≥ 0.039	2.5
		≥ 0.313	1.2	≥ 0.02	5
		≥ 0.156	1.5	≥ 0.010	10
	Kt	Temperature factor			
		Temperature	Kt	Temperature	Kt
		8-18°C	2	28-35°C	2
		18-28°C	1		
	Qx	Measured Q value			
	De	Relative D accuracy			

Specification

Test Frequency	20Hz ~ 1MHz, 5 digits, $\pm 0.0005\%$	
Input Impedance	100Ω	
Basic Accuracy	$\pm 0.1\%$ (R, Z, X, G, Y, B, L, C)	
Test Speed	AC	Max 75ms, Fast 150ms, Medium 450ms, Slow 500ms
	DC	Max 30ms, Fast 50ms, Medium 120ms, Slow 500ms
Test Signal Levels	10mV ~ 2V _{rms} , 1mV step, $\pm 2.5\%$	
Short Circuit Current	Max. 20mA	
Display Range	R, Z, X	0.01mΩ ~ 1GΩ
	G, Y, B	0.001nS ~ 1kS
	L	0.1nH ~ 100kH
	C	0.001pF ~ 1F
	D	0.00001 ~ 1000
	Q	0.01 ~ 1000
	R _{dc}	0.1mΩ ~ 100MΩ
Measurement Parameters	Impedance (Z)	Phase Angle ()
	Inductance (L)	Capacitance (C)
	AC Resistance (R _{ac})	Quality Factor (Q)
	Dissipation Factor (D)	Admittance (Y)
	Conductance (G)	Reactance (X)
	Susceptance (B)	DC Resistance (R _{dc})
Equivalent Circuit	Series and Parallel	C+R, C+D, C+Q, L+R, L+Q
	Series Only	X + R, X + D, X + Q
	Parallel Only	C + G, B + G
Polar Form	Z + Phase Angle, Y + Phase Angle	
LCD Display	320 x 240 Dot Matrix	
Interface	RS-232C, GPIB	
Power Source	AC 115V/230V (Selectable), 50/60Hz	
Accessories	User manual x 1, Power cord x 1	
	Test lead LCR-12 x 1	
Dimensions	330 (W) x 170 (H) x 340 (D) mm	
Weight	Approx. 5kg	

Declaration of Conformity

We

GOOD WILL INSTRUMENT CO., LTD.

(1) No.7-1, Jhongsing Rd., Tucheng City, Taipei County, Taiwan

(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China

declare, that the below mentioned product

Type of Product: Precision LCR Meter

Model Number: LCR-8101

are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Directive (73/23/EEC, 93/68/EEC).

For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

© EMC

Conducted Emission	Electrostatic Discharge
Radiated Emission	EN 61000-4-2: 1995 + A1:1998 + A2:2001
EN 55022: Class A 1998 + A1:2000	
Current Harmonics	Radiated Immunity
EN 61000-3-2: 2000	EN 61000-4-3: 2002
Voltage Fluctuations	Electrical Fast Transients
EN 61000-3-3: 1995 + A1:2001	EN 61000-4-4: 1995 + A1:2000 + A2:2001
-----	Surge Immunity
-----	EN 61000-4-5: 1995 + A1:2001
-----	Conducted Susceptibility
-----	EN 61000-4-6: 1996 + A1:2001
-----	Power Frequency Magnetic Field
-----	EN 61000-4-8: 1993 + A1:2001
-----	Voltage Dip/ Interruption
-----	EN 61000-4-11: 2001

© Safety

Low Voltage Equipment Directive 73/23/EEC & amended by 93/68/EEC
Safety Requirements
IEC/EN 61010-1: 2001

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